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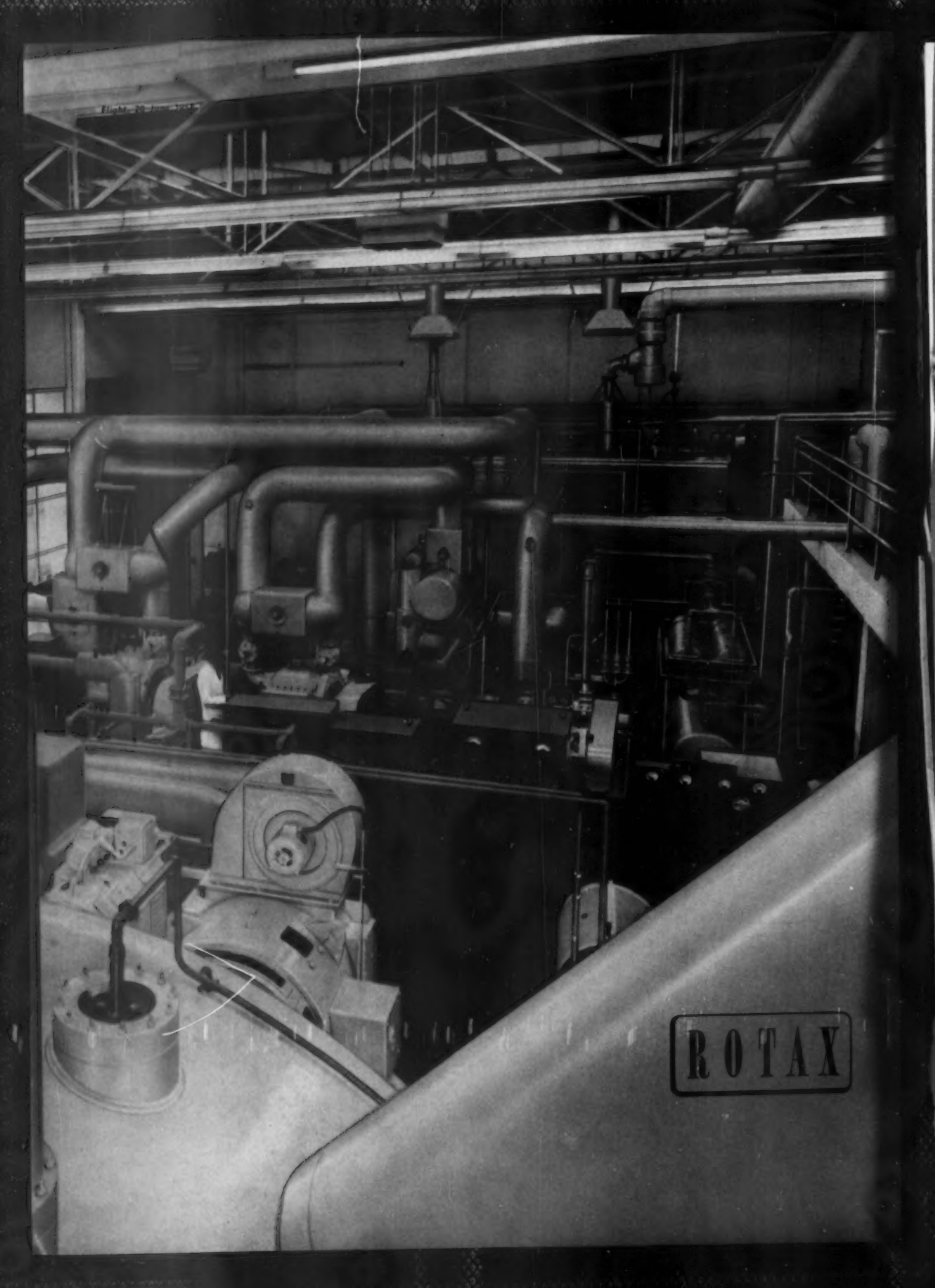
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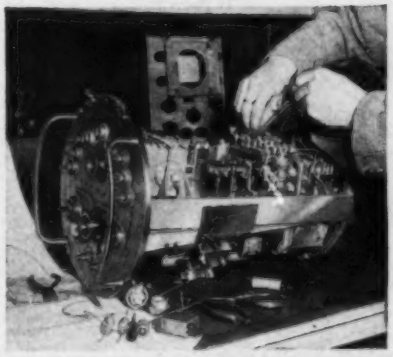

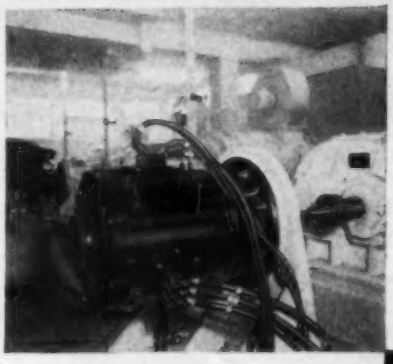

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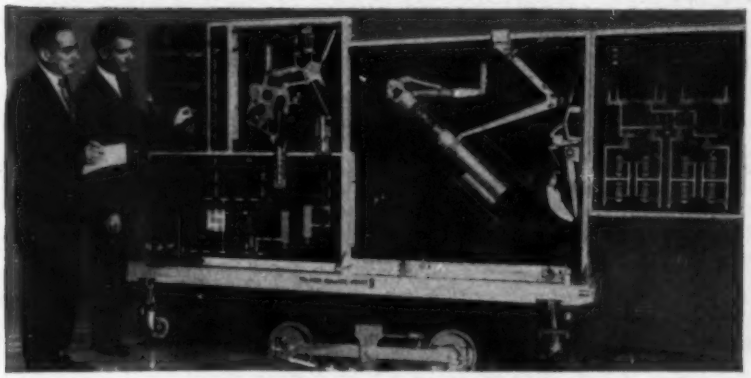
REPORT ON SERVICE SUPPORT

KEY MEN in the Boeing support programme for 707 & 720 jet liners are service engineers assigned to customer airlines. Through them, the benefits of Boeing's unequalled experience with multi-engine jets—at all engineering, maintenance and management levels in the company—are available to airlines. Boeing service engineers have spent up to 10 years with multi-engine jets, and four years with the 707 jetliner prototype.

BOEING SPARES service is designed to hold airline costs to a minimum. To enable airlines to keep parts inventories low, Boeing stocks off-the-shelf spares and insurance parts, and can ship emergency requirements within hours of receiving the order.



TRANSITION TO JETS is being aided by complete Boeing training programmes. They range from flight instruction for airline pilots to training courses for maintenance personnel, given by engineers with years of multi-jet experience. Complete manuals are available, and operable trainers, like the one illustrated above, are used to demonstrate 707 systems.

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ALLISON POWERS SIX VERSIONS OF PROP-JET C-130—A little more than a year ago the Tactical Air Command took delivery of its first Lockheed Hercules. Today this amazing prop-jet transport is operating with the U.S. Air Force in the U.S., Europe and the Far East, and soon will report for duty with the Royal Australian Air Force. Already the matched team of Allison Prop-Jet engines and Aeroproducts Turbo-Propellers has logged 200,000 flight hours powering the C-130 to new performance records as a high-speed troop, cargo and missile transport—as an in-flight refuelling tanker for fast jet fighters—as a "*Ski-130*" for Arctic use—and now as a "*See-130*" aerial map maker. Allison Prop-Jet power will soon bring record performance, dependability and operating economy to the commercial jet age, too, in the luxurious Lockheed Electra—already ordered by 11 world airlines.

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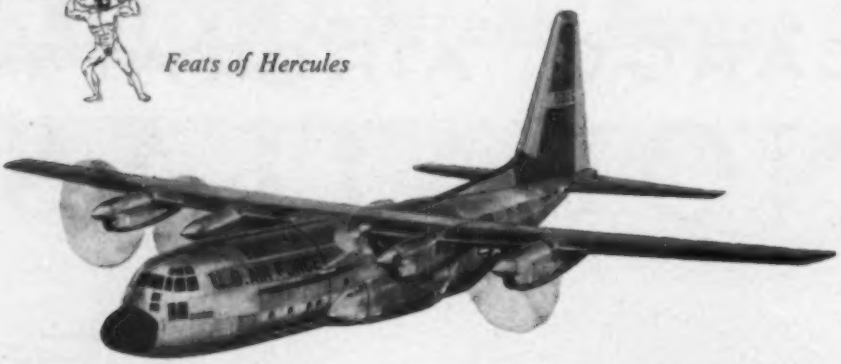
Feats of Hercules



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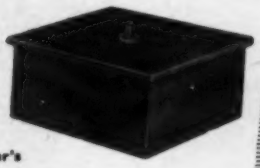

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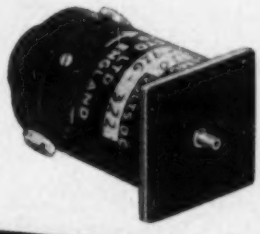

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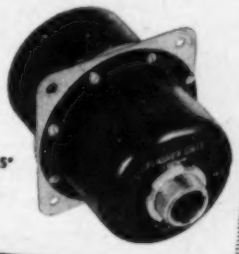

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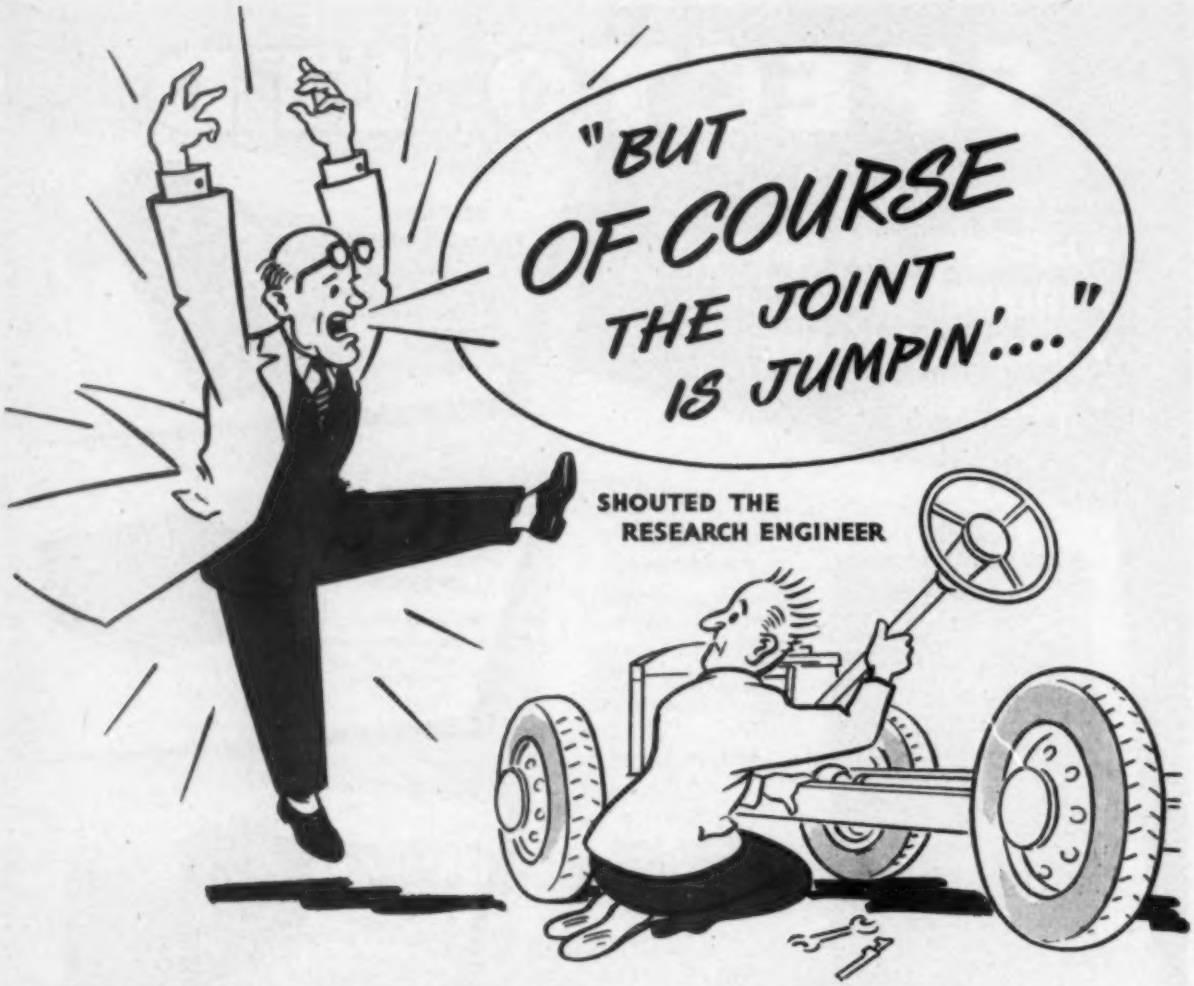

(ROCK 'N' ROLLERS, RELAX!! The research engineer is talking about vibration in the steering column of a new car under test.)

THE RESEARCH ENGINEER doesn't usually shout. Normally, he is a quiet, modest chap who (when he remembers to go home) is a good husband and kindly father. He devotes himself to digging out abstruse scientific facts and is more than happy to leave the shouting to the higher executives.

But when a slap-happy boffin from the other side of the factory challenges his findings at such an elementary level, he can't be blamed for getting a little pink about the ears. And when he reaches for his new portable Dawe Vibration Indicator to prove his point, only to find that some light-fingered ass has borrowed and failed to return it, then he really abandons cold science for hot words.

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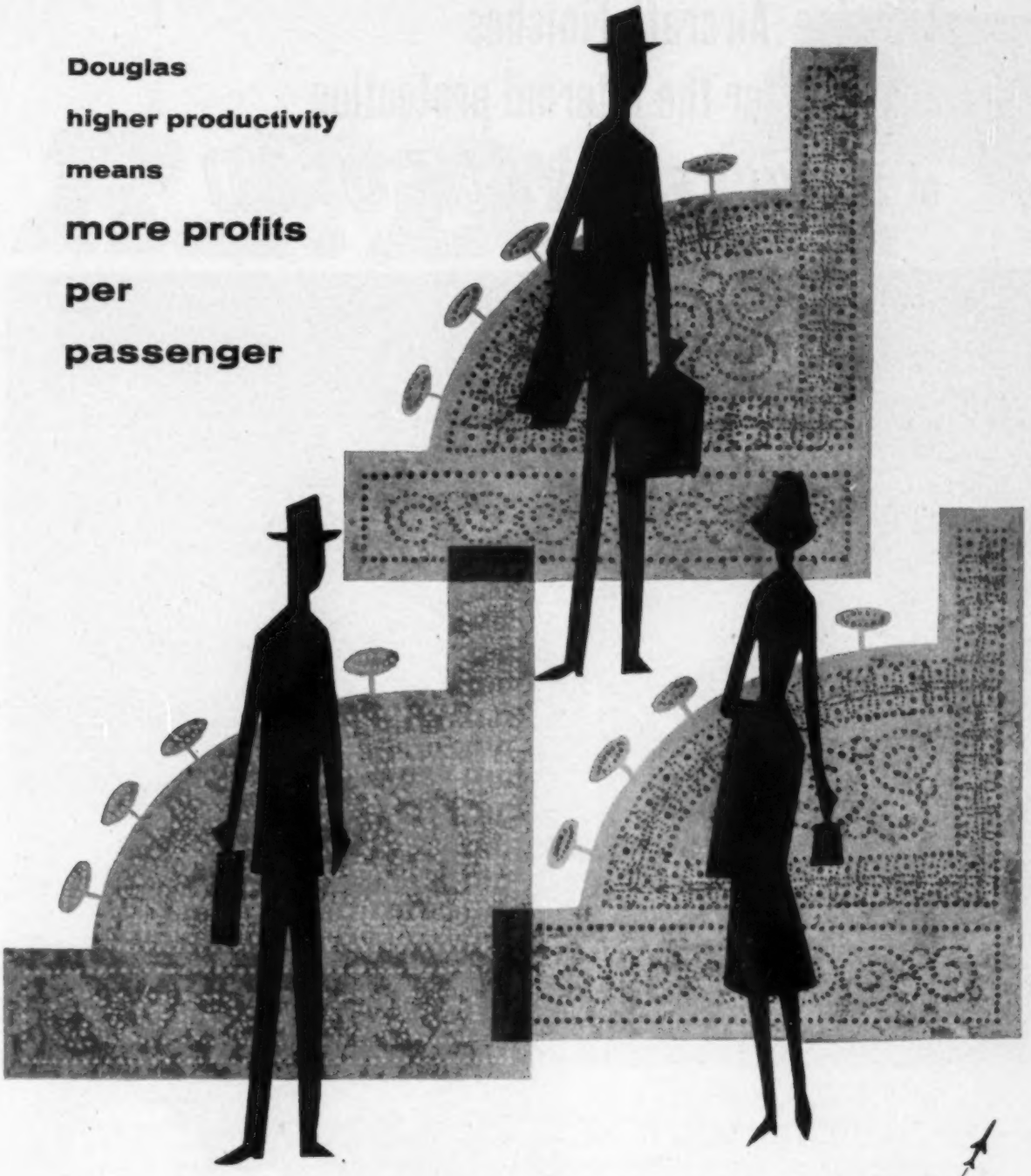

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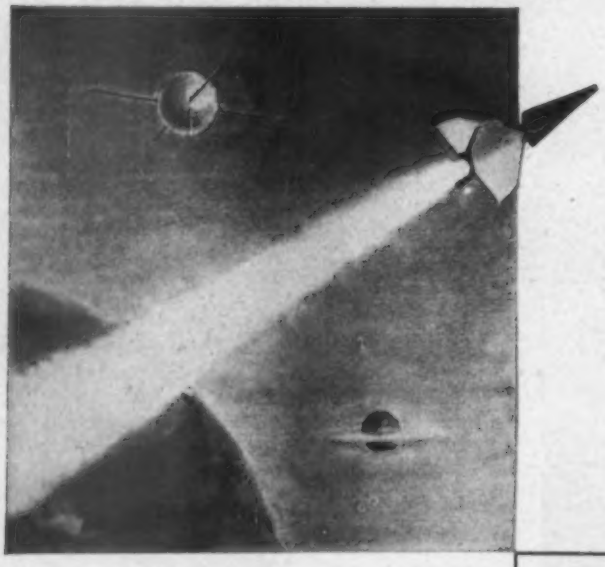

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

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Parts Greater than the Whole

ASK almost anybody what he thinks about the future of the British aircraft industry and the question is likely to be answered with shrugged shoulders and a wry face. The industry is grossly over-weight and in a shaky condition; it must "return" to some supposed proper size—namely, to its pre-1950 employment level; it must reorganize itself; and all the rest of it.

Acting and reacting upon itself, such talk creates a pall of gloom, ruinous to the morale of the worker at home and the salesman abroad. It forms in effect a great wet blanket; and the pity of it all is that this blanket is tending to obscure a very fine record of achievement.

Ignoring, for the purpose of this editorial, Great Britain's history of designing and building aeroplanes—and it is a commendable history—we can instead point to a number of small design teams in the ancillary industry who have taken on the whole world and have come off anything but second best. We may start with a team which grew from nothing at all, in 1951, in an office of D.H. Propellers, Ltd., at Hatfield. Their task: to develop a turbo-alternator power pack for a guided weapon. The result: a thriving production line of dozens of different pieces of advanced equipment for Bloodhound, Sea Slug, Firestreak and a number of the fastest aeroplanes. An engineer officer of the U.S.A.F. has himself declared: "We have nothing better than these power packs in the States." What he perhaps did not know is that the Hatfield company have never enjoyed more than a small fraction of the manpower and money expended on power systems in America.

Out at Denham, James Martin's little company of Martin-Baker have obtained something approaching a monopoly in the design of ejection seats. His products are sent all over the world—notably to the U.S.A.

The same can be said of Sir Alan Cobham's team down in Dorset: products of their design help an Indian pilot to operate his Hunter or Mystère, just as they allow the pilot of a Crusader or Super Sabre to take on fuel in flight.

Again, going further afield into the British Commonwealth, one can walk down St. Denis Street, in the French part of Montreal, and pass a car showroom belonging to a firm by the name of Jarry. Who could guess that, on one of the upper floors, designers were putting the finishing touches to the hydraulic system of the Avro Arrow? Jarry are a small company by any standards, and their resources are limited. Their decision to accept the challenges posed by the fastest aeroplane in the Commonwealth rested on a realistic assessment of their own ability. They have delivered the goods, and done it for a cost which probably amounts to about two per cent of that spent by the U.S.A.F. Air Research and Development Command on high-temperature hydraulics.

Who *was* it who said there was no room for the little man?

Watchers Below Ground

FIFTEEN feet underground a Royal Observer Corps member with an R.A.F. pilot's brevet on his blue battledress peers into a dial flickering with simulated gamma rays. Nearby are telephones for reporting nuclear fall-out to the control centre; behind him, four beds tiered into an angle of the whitewashed wall. Above ground sprouts the business end of the radiation detector; near it—like sinister meteorological instruments—are the ground-zero and bomb-power indicators. Iron trap-doors clamp down over the entrance to this underground post, which is called November 1, suggestive of darkness and December. But larks sing on the Surrey hills and in June sunlight the man from the Home Office smoothly intones ". . . after the Japanese fishermen incident, it was decided that something had better be done about fall-out. . . . About 200 posts have been or are being built underground. . . ." Nearby, in their open-air post, two observers —one a baker, the other a bookseller—plot two Javelins thrusting over from Odiham. The Corps' 15,000-odd all-weather members now have a dual rôle in Britain's defence. They will play it as well as ever—whether the scenery be the sky over Britain or whitewashed walls under the ground.

FROM ALL QUARTERS

RED HERRING: First in-flight picture of the U.S.A.F.'s SM-73 Goose, designed to act as a decoy for surface-to-air missiles. Cruise propulsion is by a Fairchild J83 turbojet of about 2,200 lb thrust, with launching by a Thiokol solid-fuel motor. Fairchild are the primary contractors.

Westminster Airborne

AT Yeovil last Sunday the Westland Westminster made its first flight. With W. H. ("Slim") Sear, the company's chief test pilot, at the controls, it was airborne for no less than 64 min—a remarkable figure for a maiden flight by any type of aircraft. Though flying was restricted to the confines of the airfield, the Westminster carried out all the normal helicopter manœuvres in hovering flight and at slow backward and forward speeds. Sear reported after landing that the aircraft handled with the ease of a small helicopter.

Weighing nearly 14 tons, the Westminster is described as "the biggest helicopter project ever undertaken as a private venture by a British aircraft constructor." D. Napier and Son, Ltd., have co-operated in the enterprise by developing the two rear-drive Eland gas turbine engines. The Westminster is intended to be used in its utility form as a crane, carrying its load from a strong-point built into the fuselage; in its passenger version it will seat 46. Only eight months has elapsed since construction started.

Vulcan's 600 m.p.h. Atlantic Crossings

AN Avro Vulcan of R.A.F. Bomber Command recently made Atlantic crossings in both directions at speeds of over 600 m.p.h. Captained by W/C. F. L. Dodd, C.O. of No. 230 O.C.U. at Waddington, and with the A.O.C-in-C. Bomber Command, Air Chief Marshal Sir Harry Broadhurst, as co-pilot, the aircraft took off from Waddington on June 3 and was over Goose Bay, Labrador, 4 hr 2 min later—having covered 2,432 s.m. at an average speed of 602 m.p.h. Flight time from take-off to landing at Goose was 4 hr 16 min.

On the return crossing (June 10) the Vulcan took off from Westover near Boston and was over Waddington—a distance of 3,310 s.m.—in 5 hr 17 min, an average speed of 621 m.p.h.

The aircraft's outward journey from Lincoln, England, to Lincoln, Nebraska—a distance of 4,300 s.m.—was covered in 7 hr 39 min flying time (an average speed of over 570 m.p.h.); and on the return it flew from March Field, Cal, to Westover (2,442 s.m.) in 3 hr 58 min at 625 m.p.h.

Olympus Type-Test

IT is announced by Bristol Aero-Engines, Ltd., that the Olympus Mk 201 turbojet (BOl. 7) has successfully completed an official military type-test at 17,000 lb static thrust. The company claims that this engine has the highest thrust/weight ratio of any type-tested high-thrust turbojet in the world.

More About Bloodhound

THERE was an echo of the recent disclosure that Bloodhound had gone into R.A.F. service (see page 790, *Flight*, June 13) when, on June 11, the Secretary of State for Air, Mr. George Ward, stated in a written reply that "trials of the Bristol Bloodhound surface-to-air guided weapon will start shortly at North Coates and the weapon will subsequently be deployed operationally in the United Kingdom."

Flying to Le Mans

SPECIAL air traffic rules will apply at Le Mans/Arnage airfield during the 24-hour race on the adjoining circuit tomorrow (June 21) and on Sunday. On June 21 aircraft equipped with V.H.F. R/T may land until 1100 hr local time but after this, in addition to V.H.F., the pilot of the aircraft must possess an I.R. and carry a valid white card (or military green). The aerodrome commandant may give special authorization for aircraft to depart from the airfield on June 21 and 22 even though they do not fulfil these conditions. Only one landing strip will be available—028/208.

Next week our associated journal *The Autocar* will publish its Le Mans Race Report issue.

The Queen's Birthday Honours

AMONG the names appearing in last week's Birthday Honours List was that of the Deputy Director of R.A.E. Farnborough, Mr. M. B. Morgan, who is appointed C.B. Members of the industry honoured include Mr. E. K. Cole (C.B.E.), chairman and managing director of the radio manufacturers bearing his name; Dr. E. S. Moult (C.B.E.), director and chief engineer of the de Havilland Engine Co., Ltd.; Mr. Lionel Haworth (O.B.E.), chief designer (civil) to Rolls-Royce, Ltd.; and Mr. R. Gray (M.B.E.), chief designer, Chloride Batteries, Ltd.

By a sad irony, one of those named as recipients of the Queen's Commendation for Valuable Service in the Air was S/L. J. S. Booth, who had lost his life in the accident to the Saunders-Roe SR.53 a week before the List appeared.

Messrs. Cole (C.B.E.), Moult (C.B.E.) and Haworth (O.B.E.).

Among the names of those to receive honours are the following (names of Service recipients of honours and awards are given on page 824):—

C.B.—M. B. Morgan, Deputy Director, R.A.E. Farnborough.

K.C.M.G.—A. V-M. Sir Robert George, R.A.F. (ret.), Governor of South Australia.

C.B.E.—E. K. Cole, chairman and managing director, E. K. Cole, Ltd.; H. Harvey, assistant secretary, Air Ministry; E. S. Moult, director and chief engineer, de Havilland Engine Co., Ltd.

O.B.E.—J. K. Garland, senior chief executive officer, Air Ministry; D. N. Harrison, principal scientific officer, Met. Office, Air Ministry; H. C. Hawkins, principal, Air Ministry; L. Haworth, chief designer, civil engines, Rolls-Royce, Ltd.; E. V. P. Miller, senior air traffic control officer, Northern Division, M.T.C.A.; J. H. Morley, engineer 1, Royal Radar Establishment, M.o.S.; S. P. Simcocks, deputy chief quantity surveyor, Air Ministry; G. Thompson, Assistant Director (Programmes), Air, M.o.S.

M.B.E.—A. B. Archer, higher executive officer, R.O.C.; J. D. Browning, chairman of committee, Nos. 66, 97 and 1924 (Croydon) Sqns., A.T.C.; G. M. Cox, lately assistant airport manager, Prestwick; A. O. Dawodu, station superintendent, West African Airways Corporation; R. Gray, chief designer, Chloride Batteries, Ltd.; Miss E. E. Grinsted, lately chief executive officer, R.A.E. Farnborough; R. W. Hanwell, senior executive officer, No. 35 M.U., R.A.F. Heywood; H. Heynes, senior executive officer, Air Ministry; E. A. Humphry, deputy superintendent, D.G. of Works, Air Ministry; Brig. M. A. James, chief civil defence officer, Bristol Aeroplane Co., Ltd.; E. G. Kirby, senior signals officer, M.T.C.A.; Capt. J. H. H. Mills, chief pilot and operations superintendent, Aden Airways, Ltd.; A. G. Nunn, senior planning engineer, B.O.A.C.; R. H. C. Phillpott, lately higher executive officer,

RECONSTRUCTED with the help of drawings and notes sent out from Weybridge, after it had been partly destroyed by fire, the Ross and Keith Smith Vickers Vimy in the new memorial building which was unveiled recently at Adelaide Airport by Air Marshal Sir Richard Williams.

CRANE-DRIVERS: Westland chief test pilot W. H. ("Slim") Sear, on left of group, with co-pilot Leo Devigne and flight-test observer Gerry Smallridge, after they had given a 64-minute maiden outing to the "crane" version of the Westland Westminster—seen airborne at right—at Yeovil last Sunday. (News item, opposite page.)

Air Ministry; G. W. Pitt, director, Eagle Aviation, Ltd.; L. Riley, works manager, Burnley Aircraft Products, Ltd.; H. G. Roberts, senior technical superintendent, No. 33 M.U., R.A.F. Lyneham; C. P. V. Roche, lately airport commandant, Jersey; S. J. O. Sarr, station manager, West African Airways Corporation; J. I. T. Scallon, secretary, Vosper, Ltd.; H. B. Stewart, chief photographer, B.E.A.; Maj. J. Stokes, technical director, Louis Newmark, Ltd.; R. Thurley, station superintendent, B.E.A., Belfast; S. T. Warne, higher executive officer, Air Ministry; G. T. White, works manager, guided weapons division, Sir W. G. Armstrong Whitworth Aircraft, Ltd.; E. A. Williams, secretary of committee, No. 936 (Hertford) Sqn., A.T.C.

Queen's Commendation for Valuable Service in the Air—Capt. N. R. G. Barker, sen. capt. 2nd class, B.E.A.; S/L. J. S. Booth (deceased), lately chief test pilot, Saunders-Roe, Ltd.; Capt. R. F. Caspareuthus, staff pilot, Civil Aviation Directorate, E. Africa; Capt. D. W. Fenton, chief pilot and operations manager, Malayan Airways, Ltd.; Capt. H. L. M. Glover, sen. capt. 1st class, B.O.A.C.; G. L. Howitt, test pilot, Air Registration Board; Capt. J. Munro, sen. capt. 1st class, B.E.A.; Capt. A. C. J. Scadding, sen. capt. 1st class, B.O.A.C.

Sailplane-collision Escapes

AT Lasham gliding centre last Saturday, June 14, a Surrey Gliding Club Slingsby Eagle T42A collided in cloud with a privately owned Sky at an altitude of 4,200ft.

The crew of the Eagle, Geoffrey Barrell and Julian Merfield, both qualified pilots, baled out and landed uninjured about three miles from the airfield. The pilot of the Sky, Lasham full-time instructor and ground controller John Messervy, found after preparing to bale out that the aircraft would fly laterally level at 65 kt, so he decided to attempt a landing at that speed. Using full opposite aileron, he achieved flat turns with his rudder, and made a normal landing although over 14ft of his port wing, including all the aileron, had been removed.

Royal Visit to Air Trainers

LAST Friday the Duke of Edinburgh toured the Aylesbury factories of Air Trainers Link, Ltd., and sampled several of the simulators and trainers being made there. Main production for the Services is centred on simulators for Hunter 6 and 56 (the latter for the Indian Air Force), Vulcan, Scimitar and P.1B.

LONG-RANGE MEMENTO: Air Marshal Sir Gilbert Nicholetts (right), Inspector-General of the R.A.F., visiting the recent Napier exhibition in London, was presented with a model of the Fairey Long-range Monoplane (Napier Lion) in which, with S/L. O. R. Gayford, he made a 5,309-mile record flight to Africa in 1933. A.V-M. Sir Conrad Collier, Napier director, is seen making the presentation.

NO WAVE-OFF: The Duke of Edinburgh making a simulated deck landing in the Air Trainers (Link) general purpose deck landing trainer. With him is Mr. M. Cox, project manager, deck landing trainer.

Mechanical analogue computers for industry and trainers for car driving, single- and two-seat aircraft and deck-landing are also being developed or produced. The company was the first to employ D.C. as distinct from A.C. computation and this has been taken up by several companies in the U.S.A. Comet 4B and Vanguard simulators are to be delivered to B.E.A. next year.

Winter Hill Inquiry

LAST week evidence was heard at the public inquiry in London which is concerned with the accident to a Silver City Bristol Freighter on February 27. The aircraft, which was on a charter flight carrying Isle of Man motor traders to Manchester, struck the ground three-quarters of a mile from the TV mast on Winter Hill, Bolton, with the loss of 35 lives. The crew survived.

As with most inquiries of this kind, piecemeal summarizing of the day-to-day evidence does not always give a fair picture of the proceedings. As we go to press, however, with the inquiry still in progress, it is apparent that the main contentions of the Crown are that (1) the first officer had tuned in his A.D.F. to the wrong beacon—Oldham instead of Wigan, and (2) that a turn had been made on the instructions of Manchester Control, whose radar had shown the aircraft—which was cleared to Wigan at 1,500ft—to be off course.

The Freighter, which had been in cloud, struck Winter Hill (1,498ft) less than half a minute later.

IN BRIEF

A production order for "a substantial number" of Wessex helicopters for the Royal Navy has been placed with Westland Aircraft, Ltd., by the Ministry of Supply. Delivery is expected to begin early next year.

* * *

A world altitude record for helicopters is to be claimed for a Sud Aviation Alouette which attained a height of 36,360ft—in only 35 min—from Bretigny on June 13.

* * *

The Avro Arrow was involved in an accident at Malton Airport on June 11 when a tyre burst on landing. The aircraft swerved off the runway and its undercarriage collapsed. There was not much damage, and test pilot Jan Zurakowski was uninjured.

* * *

R.A.F. Hunters of No. 56 Sqn. aerobatic team (which is led by S/L. R. J. S. Dickinson), a Vulcan of No. 617 Sqn. and the C.F.S. Jet Provosts are among Service aircraft participating in the R.A.F.A. displays at Exeter Airport (South-Western Area) and Staverton Airport (Midland Area) on June 28. The only surviving Gloster Gladiator is also due to make an appearance at Staverton.

SERVICE AVIATION

Royal Air Forces and Naval Flying News

S. A/C. M. Tatlow (left, with "Tradesman") and S. A/C. W. Egerton (with "Polonaise"), whose splendid Royal Tournament successes are referred to below.

Royal Promotion

THE Duke of Gloucester, formerly an air chief marshal, has been promoted to Marshal of the R.A.F. with effect from June 12. He had held his previous R.A.F. rank since 1944, having become an air vice-marshal in 1937 and an air marshal in 1941. He holds the Army rank of field marshal.

Vulcans in B.C.

TWO Vulcans of No. 83 Sqn., Bomber Command, were due to return to Waddington today (June 20) from Canada after taking part in demonstrations to mark the British Columbia Centennial Celebrations at Vancouver. These included a static display at Sea Island joint R.C.A.F. base and civil airport on June 14; a fly-past over R.C.A.F. Abbotsford, near Vancouver, on June 16; and a static display at R.C.A.F. Comox, Vancouver, on June 17. The R.A.F. detachment (which included a Hastings from No. 99 Sqn.) was under the command of A.V-M. G. A. Walker, A.O.C. No. 1 Group.

Birthday Honours

OVER 200 officers and N.C.O.s of the R.A.F., W.R.A.F., R.Aux.A.F., R.A.F.V.R., Commonwealth Air Forces and Princess Mary's R.A.F. Nursing Service are named as recipients of honours and awards in the Queen's Birthday Honours list published last week.

Among them are the Air Commandants of the W.R.A.F. and Princess Mary's R.A.F. Nursing Service, Air Commandants M. H. Barnett and A. M. Williamson, who become Dame Commanders of the Order of the British Empire; A. Cdre. D. A. Wilson, who took part in the recent nuclear tests as a medical observer, and who becomes a C.B.E.; G/C. L. MacD. Hodges, C.O. of R.A.F. Marham (also C.B.E.); W/C. F. L. Dodd, who commands No. 230 O.C.U. at Waddington (second Bar to the A.F.C.); S/L. J. H. Lewis, C.O. of the R.A.F. Antarctic Detachment (Bar to the A.F.C.); S/L. E. J. Roberts, who has done two tours as test pilot at the A. and A.E.E. (also Bar to the A.F.C.); S/L. J. R. Claydon, who was with the R.N.Z.A.F. detachment in the Antarctic (A.F.C.); and S/L. R. W. Payne, who was the R.A.F.'s top scorer in the S.A.C. bombing and navigation competition at Pinecastle and in the recent Bomber Command contest for the Laurence Minot Trophy.

A first list of R.A.F. honours and awards is published below:

ORDER OF THE BATH

Companions: A.V-M. H. R. Graham, C.B.E., D.S.O., D.F.C.; Acting A.V-M. L. M. Corbet, C.B.E., M.B., B.S. (Retd.); A. Cdre. H. H. Chapman, C.B.E., A.M.I.E.E.; A. Cdre. K. J. McIntyre, C.B.E. (Retd.); A. Cdre. W. A. Stagg, C.B.E.; A. Cdre. W. P. Sutcliffe, D.F.C.; Acting A. Cdre. W. S. Gardner, O.B.E., D.F.C., A.F.C.; Acting A. Cdre. J. A. Tester, C.B.E. (Retd.).

ORDER OF THE BRITISH EMPIRE

Dame Commanders: Air Commandant A. M. Williamson, R.R.C., Q.H.N.S., Princess Mary's R.A.F. Nursing Service; Air Commandant M. H. Barnett, C.B.E., A.D.C., W.R.A.F.

Commanders: A. Cdre. D. A. Wilson, A.F.C., M.R.C.S., L.R.C.P., F.F.R., D.M.R.E., D.M.R., Q.H.S.; G/C. R. F. Aitken, O.B.E., A.F.C.; G/C. R. J. B. Burns, O.B.E.; G/C. E. C. Harding; G/C. L. MacD. Hodges, D.S.O., O.B.E., D.F.C.; G/C. S. W. Lane, M.B.E., A.M.I.Mech.E., A.F.R.Ae.S.; G/C. T. W. Piper, O.B.E., A.F.C.; G/C. D. D. Rogers, O.B.E.; G/C. F. W. Stannard (Ret.); G/C. M. C. R. White; Acting G/C. W. A. Hammerton.

Officers: W/C. R. A. Colville; W/C. P. C. Dainty, M.B.E.; W/C. H. H. C. Hester, A.F.R.Ae.S.; W/C. J. C. Hunter; W/C. S. R. Hyland, D.F.C., A.F.C.; W/C. F. Latham, M.D., Ch.B., B.Sc.; W/C. J. L. Lendrem; W/C. T. A. M. Pritchard; W/C. A. C. Rawlinson, D.F.C., A.F.C.; W/C. R. D. Romanis; W/C. R. L. Smith; W/C. J. H. Stevens, B.Sc.; W/C. R. H. Whipp; Acting W/C. C. E. Cahill; Acting W/C. G. E. Winn, R.A.F.V.R. (Training Branch); S/L. A. Bruce; S/L. A. G. Douglass, A.F.C.; S/L. J. Gale; S/L. D. R. Locke; S/L. D. T. Stanley.

Members: S/L. K. G. Bradbury, R.A.F. Regt.; S/L. A. Denovan, D.F.M.; S/L. R. F. Hitchcock, A.F.C.; S/L. E. G. Holmes; S/L. A. Sacks; S/L. C. J. W. Soutar, M.B., B.S., L.M.S.S.A.; S/L. J. W. Whitelegg, B.Sc.(Eng.), A.M.I.E.E., A.F.R.Ae.S.; Acting S/L. C. B. Kenworthy, D.F.C. (Retd.); Acting S/L. R. G. Proctor; Acting S/L. F. C. H. Simmonds, R.A.F.V.R. (Training Branch); Acting S/L. A. F. Smith, R.A.F.V.R. (Training Branch); F/L. K. Blashill, R.Aux.A.F.; F/L. C. F. Campbell, R.Aux.A.F.; F/L. S. G. Coulson; F/L. R. H. Gould; F/L. H. T. Greenwood, D.F.C.; F/L. A. E. Grover; F/L. L. Hopkins; F/L. W. H. A. Jones; F/L. J. Mayhew; F/L. F. Pendlebury; F/L. T. A. Phillipson; F/L. F. Priestley, F/L. V. J. Rees, B.A., B.Sc., Dip.El.; F/L. J. E. Walton; Acting F/L. W. Atkinson, R.A.F.V.R. (Training Branch); F/O. F. Sykes; W/O. A. Atkin, W/O. L. R. Blake; W/O. W. A. Blewett; W/O. F. G. Booth; W/O. W. L. Bullock; W/O. C. F. Burr; W/O. T. G. Evans, R.A.F. Regt.; W/O. S. H. Ferguson; W/O. J. O. Gowland; W/O. W. A. Kemp; W/O. G. S. Laing; W/O. S. A. Lucas; W/O. G. H. Murray; W/O. G. H. L. Parker; W/O. L. Riddell; W/O. H. Riley; W/O. J. T. Rogers; W/O. R. W. Taylor.

AWARDS

Second Bar to Air Force Cross: W/C. F. L. Dodd, D.S.O., D.F.C., A.F.C.

Bar to Air Force Cross: W/C. R. G. Knott, D.S.O., D.F.C., A.F.C.; S/L. J. H. Lewis, A.F.C.; S/L. E. J. Roberts, A.F.C.

A.F.C.: W/C. W. M. Dixon, D.S.O., D.F.C.; W/C. J. E. Preston; W/C. C. S. Vos, D.F.C.; S/L. G. Bates, D.F.C.; S/L. J. R. Claydon, R.N.Z.A.F.; S/L. D. S. Collier; S/L. B. Hamilton, D.F.C.; S/L. G. K. N. Lloyd; S/L. B. T. Millett; S/L. H. Minnis; S/L. R. W. Payne; S/L. P. D. C. Street, D.S.C.; S/L. A. H. Turner; F/L. J. W. Adams; F/L. C. H. Bidie; F/L. D. A. C. M. Comer, D.F.C.; F/L. M. J. Cottee, R.A.A.F.; F/L. K. J. Dix; F/L. D. E. R. Lang; F/L. J. W. Roll; F/L. D. R. Sowray; F/L. A. E. Sweeney; F/L. O. J. Thomas; F/L. P. Thomas; F/O. K. E. Appleford; F/O. D. E. Batten, D.F.M.; F/O. F. W. Fielding; M.Plt. A. B. Collins, A.F.M.; M.Plt. I. R. Craig; M.Plt. K. A. McAllen; Lt-Cdr. W. R. Hart, R.N.; Lt-Cdr. D. J. Whitehead, R.N.

Obs. D. A. Collett using a gamma radiation detector in the underground post at Farnham, Surrey, which is a prototype of future R.O.C. equipment for reporting nuclear fall-out.

Malaya Post

COMMANDANT of the Central Flying School since January 1956, A. Cdre. N. C. Hyde was due this month to take up the appointment of Air Officer Commanding the new Federation of Malaya Air Force, which is now in process of formation.

Among A. Cdre. Hyde's post-war appointments have been the command of R.A.F. Waterbeach (1947) and of R.A.F. Binbrook (1951). In 1948 he joined the planning staff of the Anglo-American Combined Air Lift Task Force H.Q., from which the Berlin Airlift was directed, and he later compiled the official R.A.F. report on that operation. Before the war he was at the A. and A.E.E. at Martlesham Heath, where air gunnery trials with Hurricanes and Spitfires were among his duties. He took command of No. 207 Sqn., the first bomber squadron to fly Manchesters, in late 1940; but during a raid over Kiel his aircraft was set on fire. A. Cdre. Hyde and his crew baled out and he had to spend the rest of the war as a prisoner.

IN BRIEF

Two young airmen, S. A/C. M. Tatlow and S. A/C. W. Egerton, made R.A.F. riding history at the Royal Tournament when on June 7 they came first and second (riding *Tradesman* and *Polonaise* respectively) in the Prince of Wales Cup and when four days later Tatlow went on to win the King's Cup. Neither trophy had ever before been won by an airman.

* * * * *

The five Westland Whirlwinds depicted on this page in our issue of May 30 advancing towards Eastney beach, Southsea, were in fact from the Joint Helicopter Experimental Unit and not (as stated) No. 701 Sqn., F.A.A.

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The next competition for the award of R.A.F. scholarships will be held during August. Full details are published in A.M. pamphlet 325, obtainable from the Under-Secretary of State for Air, Air Ministry (A.R.I.s), Adastral House, Theobalds Road, London, W.C.1. Applications must reach the Air Ministry not later than June 30.

Straight and Level

WHEN, in France's gravest hour, General de Gaulle flies to the centre of gravity—Algeria—he flies by jet. What else but the Caravelle could have been chosen to fly France's man of destiny on such a mission?

President Eisenhower orders three jet Boeing 707s, because, to quote Mr. Dudley C. Sharp, Assistant Secretary of the U.S.A.F., "They are needed in the cold war with the Soviets, who fly their top officials in jet airliners. The United States cannot afford to suffer in comparison, a philosophy which is endorsed by the State Department."

Continental Air Lines of Denver, Colorado, paint the words *Jet Power* on the fins of their turboprop Viscount 812s (a little bit naughty, I think). T.W.A. advertise *Jetstream* services by piston-powered Super Constellations.

There is a magic about the word jet. Prodigal use of fuel, extravagant runway needs, and disturbing noise will never diminish this magic.

● Every day, perhaps every hour of every day, airliners turn back with engine trouble. This happens, perhaps, to one flight in ten thousand.

When it happens—as it happened on June 7—to a B.O.A.C. Britannia 312 in which the Prime Minister is flying to see President Eisenhower, with subsequent front-page headlines in every national newspaper, the airline concerned can consider itself plumb unlucky—even if the trouble was due, as I believe it was, to a leakage from a reduction-gear oil drain.

● I was interested to find a contributor to last week's issue saying that "This country still has enough of the right kind of men . . . . but we must have the facilities—which means the money."

Now a few years ago we were desperately—almost unbelievably—short of facilities. That is largely why we were so slow to make supersonic aeroplanes capable of doing something other than research, and why so many of our other creations didn't work as well as they should have done. But what do we have now? I think we are reasonably well served by our facilities. We have lots of supersonic tunnels; but no models to put in them. We have lots of clever rigs for advanced systems; but no new aeroplanes that the systems might go into. We have some first-class high-altitude test plant; but no new engines to run in them. What are we going to do?

It seems to me we could reap a nice short-term harvest by exporting our facilities to some nation with enough courage to use them.

● Temco, of Dallas, are not usually thought of as major builders of aircraft, yet their contribution to the American airframe industry is massive. At the moment they are making rear fuselages for B-52s, B-47s, F3Hs, F-84Fs and F-101s, wings for F3Hs and P2Vs, wing-tips, flaps, ailerons and pylons for F-100Cs and Ds, photo-noses for RF-101s and RF-105s, floor panels for C-130s, and a whole lot of other items, besides being one of the biggest overhaul and modification firms in the business. There is no comparable British firm; not even Folland could claim to be making so many bits of other people's aeroplanes.

● Would the gentleman who lost his bowler hat at the Helicopter Association's recent garden party like to apply to me? I think I can tell him what happened to it.

Hats off to the Westland Widgeon—and to *Flight's* photographer.

Just imagine what will happen when helicopters begin large-scale operations into the City of London.

● After the opening of Gatwick last week, which I thought the Queen did perfectly, a *Flight* colleague had a look round the new base of Transair, the independent airline. Two things in particular struck him as original ideas which may well go further (like Transair's wheel modification to improve DC-3 performance).

One idea was the maintenance docking—or rather the lack of maintenance docking—used for Viscount checks. Like all good ideas, this one is very simple: let the aircraft sink into the hangar floor, so that everything that needs to be got at most—powerplant, controls, equipment-bays, etc.—is accessible from ground level.

All you need are three hydraulically-operated platforms let into the hangar floor (and positioned to correspond with the wheels) and, of course, pits for the propellers. This idea came from Transair's projects manager, Mr. Harvey, and was implemented at a cost of £4,000 by Weaver, Ltd., of Bedford.

A maintenance dock may cost anything up to £50,000, and permanently tie up valuable hangar space. It is a passing thought that with such floor lifts B.E.A. might not have needed all of the hangar extension now being built for them. Admittedly, you still need a Giraffe to get at the fin and top fuselage—but I should not have thought that this was particularly inconvenient or expensive.

The second Transair idea costs a few pounds, and shows no immediate return on investment. But if you have an opportunity to see the new summer uniforms of the company's stewardesses—blue cotton chemise-line dresses and close-fitting straw bonnets—I think you might reckon they are worth it. Stewardesses are an airline's best advertisement, and worth good presentation. In fact, it might be an idea to put stewardesses under the control of publicity and advertising departments, instead of under the operations divisions—though I don't know what the pilots would say to that.

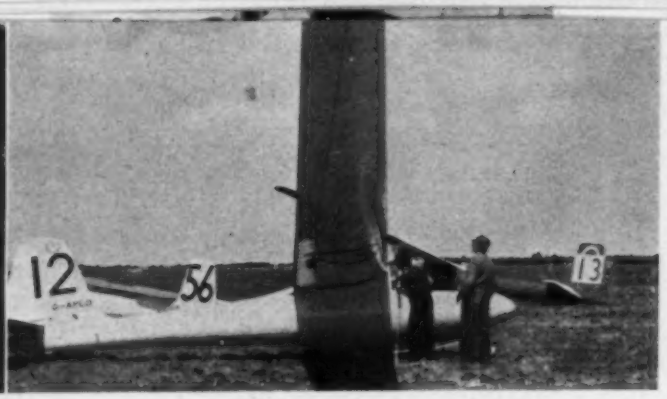
● The lesson of Capital Airlines has been salutary. The first American airline to undertake large-scale re-equipment with turbine airliners (60 Viscounts), they flew into the red *despite* (1) the fact that they reduced operating costs, (2) had negotiated probably the best re-equipment credit-terms in history, and (3) achieved major increases in business—mainly at the expense of competitors.

What will happen to the rest of the U.S. industry when it introduces its new equipment? Though they haven't all got such tough route-networks as Capital, I doubt whethey they will achieve big decreases in operating cost; I am certain that their credit is already strained to the limit (with nearly one-fifth of their capital liabilities yet to be found); and I am sure they cannot count on big increases in business without reducing the fares which they are now trying to raise. Obviously they won't, like Capital, get their new traffic at the expense of competitors.

I just hope that this is gloom-mongering, because I cannot believe that the mighty U.S. air transport industry will take an economic step backwards on to Federal subsidy.

● Those who have studied the air cargo surveys of Professor Stanley Brewer will agree, I think, that his contribution to the freighting business has been considerable (see *Flight* of June 6 for example). I don't know how many copies of each weighty document he sends out from Washington University, but they must generate quite a lot of air freight ton-miles.

ROGER BACON



Left, trailers and cars about to cross the German/Czech border on Sunday, June 8 (iron curtain in lifted position). Right, Tony Deane-Drummond and wife Evie with their Olympia 419. In right background are Nick Goodhart's Skylark 3 and the tail of Wills's Skylark 2.

World Gliding Championships

"Flight" Story and Pictures

by KENNETH OWEN*

Leszno Airfield, near Poznan. Sunday, June 15.

EACH time it happens, yet each time it comes as a many-coloured and graceful surprise—the bright elegance of a world-championship assembly of sailplanes. Today at Leszno, where the seventh World Gliding Championships were formally opened by the Prime Minister of Poland, Mr. Jozef Cyrankiewicz, was no exception. Adding further colour to those of the gliders lying on the tough, green grass of the airfield were the flags of the 22 nations whose teams have journeyed here to fly and to compete.

For the British team, the journey had begun at Buckingham Palace on Thursday, June 5, when (as we recorded last week) the Duke of Edinburgh had entertained pilots and crews to tea and had wished them well in the contests. The next day the five cars and four glider-trailers crossed from Dover to Dunkirk, and were driven through France, Belgium and the Netherlands to München-Gladbach in West Germany, where the first night stop was made. Having resisted firmly the temptation to divert to the Brussels World Fair when the unique atomium appeared on the horizon, the team arrived at München-Gladbach just after midnight.

Saturday's driving brought us as far as Nürnberg by early evening. The cars were not keeping together in convoy: each was making its own speed, but was keeping in radio contact with the others.

So far the trip had been straightforward, each night-stop being made according to plan. From Nürnberg, however, Sunday's journey was rather more uncertain, as we did not know where we would spend that night. This followed the last-minute change of route which had included Czechoslovakia in place of East Germany because of frontier difficulties.

The first barrier to be crossed that day was the reputedly iron one between Germany and Czechoslovakia. This was accomplished for the expenditure of two hours of our time at the border, where the Customs man seemed particularly interested in the carefully packed Deviscogitator in Team Car No. 1. I hope to reveal operational details of this piece of secret equipment in subsequent reports from Leszno.

From the border, team captain Mrs. Ann Welch drove ahead to Prague in order to arrange through the British Embassy there our accommodation for the night—this complication being caused by our transit visas. By the time we arrived in Prague, all was arranged and we were speedily directed on to Hradek Kralove, some 60 miles on—but not before we had been more than surprised by a loud-and-clear flood of Czech speech over the inter-car radio, interrupting traffic directions between the two Goodhart cars at a particularly busy street-junction.

At Hradek Kralove the cars and trailers were effectively engulfed by the local populace as soon as we pulled up outside the hotel—the first of many indications of the intense interest and curiosity which we seemed to cause throughout Czechoslovakia and Poland during our journey. The next day we made an early start, negotiated the Czech/Polish border, and arrived at Leszno at about 5 p.m. It was the first day of the practice week, and all the flags were not yet up to greet us—the flagpoles and some of the buildings were still being painted, in fact—but the weather was good and we had arrived.

Five flying days remained before the opening of the championships, and never have five days been better employed. On Tuesday morning the weather was not good and the team was able to sort itself and its equipment out after the journey. As the crews rigged and adjusted their gliders—the massive world two-seater championship trophy had made the trip, appropriately enough, in the cockpit of Nick Goodhart's Skylark 3—the various specialists got on with their own jobs. John Williamson was sitting in the back of Philip Wills's car testing and tuning his radio equipment; Harry Midwood was organizing the aircraft spares in the stores tent which had just been erected; and Wally Wallington came over from the met. office after a while to talk weather with the pilots. Over the loudspeakers came the most fantastic selection of gramophone records, ranging from the excellent Polish national choir to the rock 'n' roll type of Western musical culture. The British team's gliding in Poland began after lunch at five minutes past two, when Nick Goodhart was hitched up to one of the Junak 2 tugs and smartly launched.

Aerotows in Poland, we immediately discovered, are not the same as aerotows in England. Instead of the 200ft length of tow-rope to which the British pilots were accustomed, these Junaks carried 20-metre ropes—equivalent to only one wingspan. Their rate of climb after take-off, however, was exceptional: this, combined with the short tow, led Philip Wills to comment that evening that he had been able to look over the tug pilot's shoulders down into his cockpit and to read his (the tug pilot's) instruments—almost.

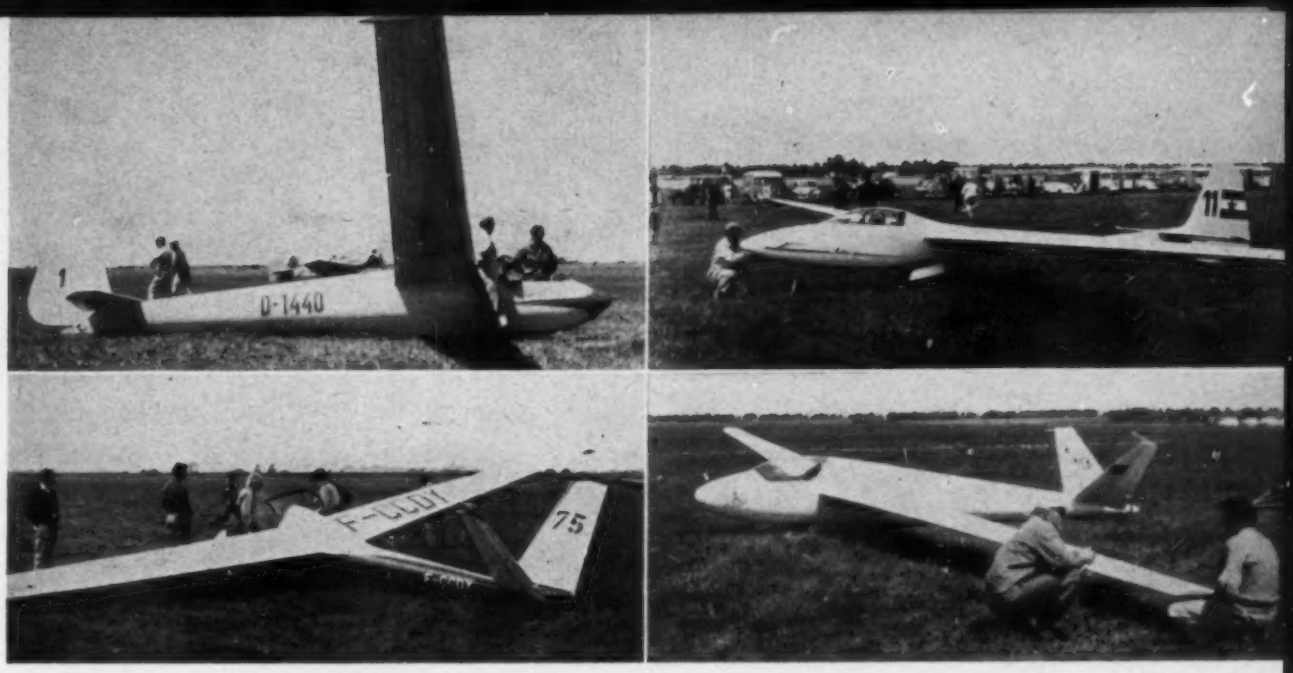
The following day, Wednesday, June 11, an out-and-return race of about 80 miles to Sroda was set as a practice task. The British pilots did not complete this task, but their landings away from Leszno gave useful practice for the retrieving crews—and for the organization at the Leszno end, which seemed not very well adjusted to the requirements of many foreign-speaking crews who were giving, or wishing to receive, information by telephone.

It was the Thursday, Friday and Saturday, however, that made the practice week something really out of the ordinary. The respective tasks were triangular races of 100, 200 and 300 kilometres, and the soaring conditions were superb. The four British pilots all completed the triangle on Thursday, Deane-Drummond with a time of 1 hr 40 min; but the day's fastest time of 1 hr 14 min was set up by Komac of Yugoslavia in one of the incomparable Meteor 57s.

Some idea of Friday's conditions can be gauged from the fact that no fewer than twelve national records were broken around the 200 km triangle. Among them was the British record, which Tony Deane-Drummond (the existing holder) pushed up by a useful margin. Komac in the Meteor almost gained first place again but, although breaking the Yugoslav national record for the triangle, was beaten by 15 seconds by Haase of Germany in the HKS. 3, whose time was 2 hr 36 min.

On Saturday, John Williamson, reserve pilot to the British team, flew the Olympia 415 in place of Tony Goodhart (who was not feeling well) over the 300 km triangle. Once again it was Komac in the sleek Meteor who flashed over the finishing line first, followed shortly by Deane-Drummond in the Olympia 419 and one of the Czech Démants. Nick Goodhart in his Skylark 3 did well to beat Deane-Drummond's time by three minutes. Philip Wills in the Skylark 2 completed the first two legs of the triangle and then continued south-east in an attempt to complete a 500 km flight. News of his landing, made some 15 km short of his goal, was

* *Kenneth Owen of "Flight" editorial staff is a member of the British team, for whom he is acting as Press and publicity officer.*



Top left, the German-built Geier 2 flown by Gordon Oates of Canada. Top right, Yugoslav Meteor 57 (pilot, Komac). Lower left, Bréguet 905 Fauvette (Labar). Lower right, German HKS. 3 (Haase).

received at Leszno late that night (and the returning car, trailer, pilot and crew arrived back at the airfield just a few minutes before the opening ceremony began today).

During the Saturday morning the international jury for the meeting, composed of the national team-captains, discussed a number of violations (most of them minor) of the standard-class requirements by some of the competing aircraft. It was decided to accept all the entries, with the proviso that the Hungarian Standard Futar should be flown with its retractable undercarriage fixed in the extended position. Retractable undercarriages are not allowed under the regulations for the standard class.

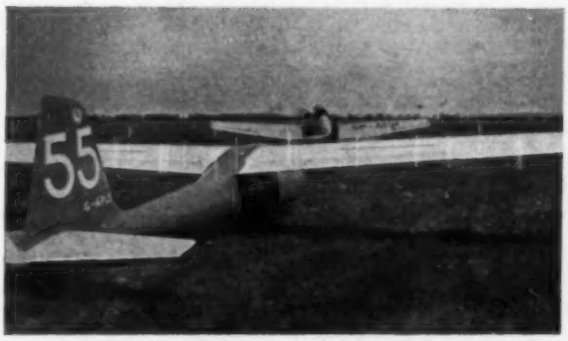
The three days' fine soaring weather have confirmed the high performance under such conditions of the expensive, all-metal Meteors. It has come as a surprise that the Russians, making their first appearance at a world championship meeting, are using Polish Jaskolka Zs and a Mucha-100, and not machines of their own design. In the standard class, the star turn is undoubtedly the dainty red-and-white Bréguet 905, vee-tailed and incredibly light, flown by Labar. The British products from Kirbymoorside and Newbury have nevertheless stayed near the top. We are now waiting for the real thing, the championships proper.

STOP PRESS: Unofficial results of Monday's flying placed Haase (HKS. 3) first in the open class. He flew 235 km (about 146 miles) to Jelenia Gora and back in 4 hr 8 min 57 sec.

(To be continued)

The Olympia 419. To give credit where credit is due, our description of this sailplane in last week's issue should have included mention of the fact that redesign of the 403 to give improved tailplane balance and low-speed performance in the 419 was entrusted to Messrs. P. J. Michelmore and M. Reed of Aviation Projects, Ltd., together with Mr. J. E. Cramp of Elliotts of Newbury, Ltd.

Tony Goodhart's Olympia 415 ready for take-off.



THE ENTRIES

No.	Pilot	Nationality	Sailplane
	Open Class		
1	Gordon Oates	Canada	Geier 2
2	Charles Yeates	Canada	Bréguet 901
3	Lajos Legenyei	Hungary	Siraly 2
4	Erno Kisely	Hungary	Siraly 2
5	Harry Molander	Sweden	Zugvogel 3
6	Erik Burditt	Rhodesia	Jaskolka
7	Stanley Smith	U.S.A.	Bréguet 901
8	Lyle Maxey	U.S.A.	Zugvogel 3
9	Paul Bikle	U S A.	Bréguet 901
10	Aleksander Saradic	Yugoslavia	Meteor
11	Bozidar Komac	Yugoslavia	Meteor
12	Tony Deane-Drummond	Gt. Britain	Olympia 419
13	Nicholas Goodhart	Gt. Britain	Skylark 3
14	Evert Dommisse	South Africa	Jaskolka
15	Leopold Harrer	Austria	Mg. 23
16	Josef Fuhringer	Austria	Mg. 23
17	Georg Fannes	Austria	Mg. 23
18	Hans Resch	Austria	Mg. 23
19	Ernst Haase	W. Germany	HKS. 3
20	Jakob Laur	W. Germany	Zugvogel 3
21	Hanna Reitsch	W. Germany	Zugvogel 3
22	Isamu Oda	Japan	Jaskolka-bis
23	Keith Wakeman	New Zealand	Jaskolka Z
24	Age Thomsen	Denmark	Mu 13d
25	Marian Gorzelak	Poland	Jaskolka Z
26	Edward Makula	Poland	Jaskolka Z
27	Alberto Araoz	Argentine	Skylark 3
28	Rolf Hossinger	Argentine	Jaskolka-bis
29	Michal Zwieriow	U.S.S.R.	Jaskolka Z
30	Michal Wierietiennikow	U.S.S.R.	Jaskolka Z
31	Wiaczeslaw Jefimienko	U S.S.R.	Jaskolka Z
32	Daniel Barbera	France	Bréguet 901
33	Jean Welss	France	Bréguet 901
34	Jaroslav Kumpost	Czechoslovakia	Spartak
35	Vaclav Marecek	Czechoslavakia	Démant
36	Rudolf Mestan	Czechoslavakia	Démant
37	Ladislav Haza	Czechoslavakia	Démant
38	Rene Fonteilles	France	Bréguet 904
	Standard Class		
51	Francis Compton	U.S.A.	Mucha-100
52	Nandor Optiz	Hungary	Standard Futar
53	Per Axel Persson	Sweden	Zugvogel 4
54	Irve Silesmo	Sweden	Zugvogel 4
55	Anthony Goodhart	Gt. Britain	Olympia 415
56	Philip Wills	Gt. Britain	Skylark 2
57	Jorgen Friis	Danmark	Olympia 2
58	Mogens Petersen	Danmark	Ka 6
59	Niels Sejstrump	Denmark	Olympia 2
60	Willem Toutenhoofd	Netherlands	Skylark 2
61	Johannes Kaay	Netherlands	Skylark 2
62	Wasilije Stepanovic	Yugoslavia	Ilindenka
63	Heinrich Huth	W. Germany	Ka 6
64*	Hans Resch	Austria	Austria-Standard (?)
65	Harald Tandefeld	Finland	Ka 6
66	Juhani Horma	Finland	PIK.3c
67	Zvonimir Rain	Yugoslavia	Ilindenka
68	Jerzy Wojnar	Poland	Mucha Standart
69	Adam Witek	Poland	Mucha Standart
70	Juan Sadoux	Argentine	Skylark 2
71	Andre Xhaet	Belgium	Mucha 100
72	Pierre Lafosse	Belgium	Ka 6b
73	Wiktor Gonczarenko	U.S.S.R.	Mucha-100
74	Donald Brown	Australia	Mucha-100
75	Camille Labar	France	Bréguet 905 Fauvette

* Alternative entry to No. 18.

CIVIL AVIATION

Gathered around the first DC-8 at Douglas, Long Beach, is the family of aeroplanes which has made the biggest contribution to the development of the world's air transport. This picture symbolizes two decades of airliner development: and it is by no means unlikely that representatives of each type will still be found at work two decades hence. From l. to r.: DC-3, DC-4, DC-6 (C.118), DC-7.

COMET IN NEW YORK

DURING June and the first part of July, B.O.A.C. hope to make some seven demonstration flights with a Comet 2E from New York International Airport. (Of the two Comet 2Es operated by B.O.A.C. on proving flights, only one belonged to the Corporation. The other has now been returned to the Ministry of Supply.) Permission for these flights, which has been granted by Mr. Donald V. Lowe, chairman of the Port of New York Authority, has been based upon noise-level tests upon the Comet 3 (Comet 4 prototype). Bolt Beranek and Newman, the Port Authority's consulting acoustical engineers, tested the Comet 3, equipped with noise suppressors, at Hatfield last November; and the aircraft was granted in March conditional permission to make demonstration flights at the International Airport.

Sound-measurements on the Comet 2E were made by de Havilland to a pattern established by P.N.Y.A.'s acoustics engineers. They showed that the 2E, which has noise-suppressed Avon RA.29s in the outboard nacelles and unsilenced Avon 117s inboard, would be two decibels quieter than the Comet 3 at 2.2 miles from the start of the take-off run. Because the 2E has a higher power-weight ratio than the Comet 3, it will climb to 1,300ft in this distance, compared to 900ft for the Comet 3.

The Authority, in granting permission for these demonstrations, insists that they be made only in daylight, under visual meteorological conditions, and conform to the preferential runway system of the National Air Transport Co-ordinating Committee.

DOPPLER OVER THE SEA

DURING the past few months a number of airlines have been evaluating various Doppler navigational devices and reports being received indicate that some trouble is being experienced in operation over sea.

During recent weeks trials have been carried out with a Marconi AD.2300 Doppler system in a Canberra, the aim having been to confirm the predicted performance so that there should be no doubt as to what the equipment would do when operated by the airlines, in particular over the sea.

The Canberra was flown at 400 kt over sea at altitudes of over 45,000ft. With a surface wind of 10 kt the aircraft was banked to angles of 45 deg. Under these conditions, state Marconi, the equipment continued to function normally, remaining locked-on to the signal at all times. Even with a surface wind of less than five kt and a smooth sea the equipment remained fully operational.

Such conditions impose a demand on Doppler as severe as is ever likely to be experienced with airlines operating the new jets such as the Comet 4, Boeing 707, or the Douglas DC-8. Marconi military Doppler units have been operating at altitudes in excess of 50,000ft for the past few years. But these use a pulse system, and Marconi must feel pleased to have established that an equivalent performance is obtained with the lightweight low-power frequency-modulated system embodied in their civil AD.2300.

This formal line-up—perhaps more formal than the occasion which it records—shows (l. to r.) Sir Geoffrey de Havilland; Sir Gerard d'Erlanger, B.O.A.C.'s chairman; Mr. A. F. Burke, D.H. Aircraft managing director; Mr. Basil Smallpeice, B.O.A.C.'s managing director; Mr. A. S. Kennedy, D.H. Aircraft director; and Mr. C. T. Wilkins, D.H. chief designer. The picture was taken at Hatfield on June 6, when Sir Gerard and Mr. Smallpeice made a 1½ hr test-flight in the first production Comet 4.

RISKS OF CHARTERING

A DISASTER which took place seven years ago near Llandow, Wales, in which 80 people returning from an Ireland-Wales rugby match lost their lives, was recalled quite recently in an income-tax case heard before the Court of Appeal. A.V-M. Donald Bennett was appealing against a decision of the Special Commissioners for Income Tax that he was liable to pay £21,000, a ruling that had been upheld last December in the Chancery Division of the High Court. This liability had arisen in respect of a Tudor V aircraft owned by the appellant and hired to Fairflight, Ltd., a company of which he and his wife were the sole directors.

The relevant section of the Income Tax Act deals with the taxpayer's position in respect of plant or machinery for which an initial allowance or deduction has been granted. It provides that a charge—known as a balancing allowance—shall be made against a taxpayer who has received the benefit of the initial allowance if any of the following events occur before his particular trade is permanently discontinued: that the plant or machinery is sold; that it ceases to belong to the taxpayer because a foreign concession has come to an end; that the plant or machinery is destroyed; that it goes out of use as obsolete, or becomes otherwise useless, or is no longer required.

According to this section the appellant in the present case was liable to pay the balancing allowance unless destruction of the aircraft was preceded by cessation of his aircraft hire business. It appeared that on January 31, 1950, he had written to the secretary of Fairflight, Ltd., intimating that he wished to give notice to end the hiring agreement as he was planning to give up the business of aircraft hire. (This business had been started when A.V-M. Bennett purchased two Tudor Vs for use in the Berlin Airlift.) Only a few months after this communication, one of the two Tudors crashed while on a charter flight. Capital allowances amounting to £21,000 had been granted on this particular aircraft in the year 1948-1949. The Income Tax Commissioners subsequently decided that the owner was liable to an equivalent balancing-charge as the hiring business had not been discontinued at the moment of the aircraft's destruction.

Sir Andrew Clark, Q.C., for the appellant, contended that destruction of the aircraft and discontinuance of the hire business took place simultaneously. A.V-M. Bennett, informed of the disaster by telephone, had immediately manifested his intention of withdrawing from the aircraft-hire business.

Giving judgement, Lord Justice Jenkins concluded: "I cannot

'So this is a Nine-g structure...

but how about Economic Strength?'

The airline accountant has his own standards of judging an aircraft. From the financial point of view, two features of the Viscount 810/840 are outstanding. It is 50% cheaper than any other four-engined turbo-prop, and seat mile costs will be even lower than earlier Viscounts.

With this low first cost and economy in service goes the passenger appeal which keeps load factors high and ensures profitable operation. The new Viscount 810 already has a cruising speed of 365 m.p.h. The changeover to more powerful Rolls-Royce engines in 1960 will give 400 m.p.h. cruising.

The success of Viscounts is based on two important facts. Passengers prefer them—and they produce healthy airline balance sheets.

VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART PROPELLER-TURBINE ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT 574

MARCONI

DOPPLER NAVIGATOR

No loss of performance at high altitude over calm sea

The Marconi Doppler Navigator, AD 2300, has recently been flown many times at altitudes greater than 45,000 feet over sea with surface winds of only 5 to 10 knots. Under these severe conditions, with 45 degree angle of bank, the equipment operated with absolutely no loss of technical performance.

MARCONI DOPPLER NAVIGATOR AD 2300

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

On page 831 we refer to the Britannia demonstrations last week in Spain, Portugal and Cuba. Here the aircraft —one of the 305s earmarked for North-east (with its original British registration G-ANCD), but temporarily painted in Cubana colours for demonstration purposes—is seen at Barajas, Madrid. Cubana's two 310s will be delivered later in the autumn of this year.

Among the M.B.E.s in the Queen's Birthday Honours List is Mr. Harold B. Stewart, B.E.A.'s chief photographer. He has been with the Corporation since 1946. (Honours List names—pages 822-3 and 824.)

CIVIL AVIATION . . .

accept the submission that the two events took place simultaneously. I think that in this most unusual case the liability to the balancing charge does arise." Lord Justice Parker agreed, but added: "I cannot help feeling sorry for A.V-M. Bennett. In January 1950 he clearly expressed his intention to discontinue his trade of hiring aircraft and he was going to sell the two he owned. If he had succeeded in selling both, I do not think he could have been assessed to any balancing charge. If both planes had been simultaneously destroyed on the ground he would not have been subject to any assessment."

This case serves to illustrate the kind of consideration which has to be kept well in mind when hiring-out such vulnerable and expensive plant as aircraft, with their liability to sudden and total destruction, perhaps immediately after heavy capital outlay has been incurred upon them.

ALL THE WAY BY FLIGHT LOG

IT seems that, in a small way, navigation history was made on June 1. A B.O.A.C. DC-7C, G-AOIB, commanded by Capt. Bulloch, showed that it is now feasible to fly from London to New York entirely on Decca equipment.

New York's Bendix-Decca Navigator chain, which extends its coverage to the heavy-traffic area of Canada's Maritime Provinces, is now in operation, and the DC-7C was able to monitor its approach to New York by using this chain. Having flown from London by the Dectra long-range navaid, the crew had completed (or rather shown, to the satisfaction of the commander, that it was able to complete) its flight on the short-range Decca Navigator —using virtually the same equipment and presentation.

Thus it is now possible to select one set of charts at almost any airport in Europe (or conversely in the New York or Maritime areas), put them on a Flight Log, and fly Decca-Dectra-Decca from departure to approach.

ON THE MOSCOW TARMAC

A CORRESPONDENT recently returned from Moscow reports seeing four Il-18s there. He was shown around one aircraft with a 75-seat interior. "The hostess and engineer told me," he writes, "that other configurations allow for 85 and 99 seats." Cruising speed was quoted as 350 m.p.h. at a height of 26,000 to 33,000ft, and range 3,100 miles plus one hour stand-off. Engine power was given as 4,000 s.h.p. plus 400 e.h.p. jet thrust.

Il-18s are being offered, our correspondent says, at a price of $1 million, with four months' delivery; and although they are not yet in Aeroflot service Il-18s are expected to be on the Moscow - Brussels route later in the year. No decision about equipment for the service to London yet appears to have been made.

The number of Tu-104s in service may now, he writes, be 75 or more. He incidentally reports seeing a Tu-104 land streaming a tail parachute.

CARRYING THE TORCH

OLYMPIC AIRWAYS have recently celebrated their first birthday. It is now just one year since the new airline opened international services with a DC-6B chartered from U.A.T., and the European travelling public started to become aware of Mr. Onassis' entry into air transport. A short while previously this airline had started services in the Eastern Mediterranean using a motley fleet—14 DC-3s, one DC-4 and a Fairchild Argus—inherited from State-owned T.A.E.

The present pattern of operations shows the DC-6B operating a five flights-per-week service from London to Istanbul, Nicosia and Beirut, services being routed via Paris, Rome and Athens. The DC-3s and the DC-4 share the one-class domestic network radiating from Athens, and other international services to Cyprus and Egypt. In the coming summer this pattern is to be transformed by the acquisition of three new DC-6Bs and a few used DC-4s, the former allowing the existing London service to be stepped up to a daily flight, and new services being added to Switzerland and Germany, while the DC-4s will concentrate on shorter-haul services (particularly that from Athens to Brindisi via Corfu, a route being used by a steadily rising volume of traffic that has travelled down through Italy by rail).

Despite rumours to the contrary, the company has every intention of taking delivery of its two DC-8s in 1960. As expected, these aircraft will be put on to North Atlantic operations.

The management of Olympic Airways is very much aware of the attractions to British holidaymakers of the Greek mainland and of the Aegean: as many French, Italian and Spanish resorts are becoming packed with "inclusive tourists," there is a growing demand for travel to points farther abroad. Evidence of this awareness was the recent visit to London of a team of seven senior Olympic executives "to familiarize themselves with the U.K. scene."

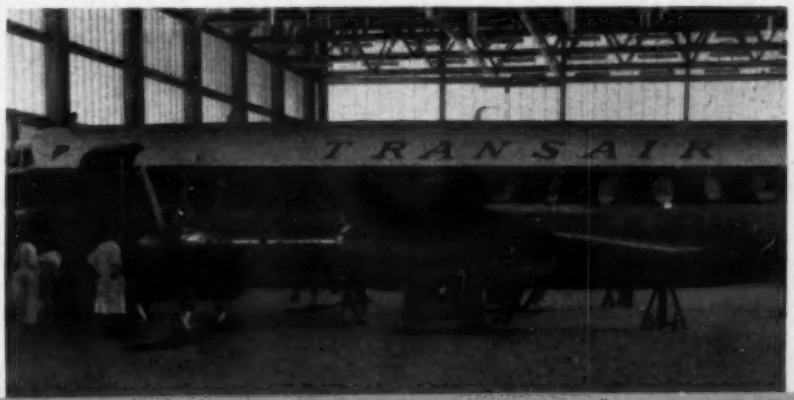
CORPORATION TO COMPANY

THIS coming autumn will see West African Airways Corporation changing its title to reflect conversion from a wholly government-owned organization to a limited company, yet probably retaining the initials "W.A.A.C." that have now acquired a considerable goodwill value.

Chief Samuel Akintola, Nigerian Minister of Communications, has recently visited London to discuss, among other things, details of the new company in which his Government will be the major shareholder, substantial minority shares being held by B.O.A.C. and by Elder Dempster Line. Share capital will be raised well above the present level of £2m to something in the order of £6m, allowing both an early expansion of W.A.A.C.'s long-haul services and re-equipment in a few years' time to be financed.

In another sense, the Corporation will part company. Internal

Referred to on the next page is Transair's simple substitute for expensive, space-consuming maintenance docks. One of the Gatwick-based airline's three Viscount 804s is seen being lowered to the hangar floor by means of retractable wells under each leg. The majority of major check-work can be done at floor-level without the need for steps, ladders or platforms.
"Flight" photograph



CIVIL AVIATION . . .

services within Ghana have in the past been flown by W.A.A.C. After many months of hesitation, in which K.L.M. have frequently been mentioned, the Ghanaians have decided to form their own airline, Ghana Airways, in association with B.O.A.C. Under a long-term agreement, the British Corporation will assist in the development of this new carrier. Local services will be taken over from W.A.A.C., while the Accra - London route will initially be operated with Stratocruisers on charter from B.O.A.C. As in the Nigerian proposal, official and commercial capital will come together, Ghana Airways capital being subscribed 60 per cent by the Government and 40 per cent by B.O.A.C.

TRANSAIR'S NEW BASE

THE first airline to adopt the new airport at Gatwick as its base is Transair, the independent operator of three Viscount 804s and 11 DC-3s. The airline's base at Croydon, occupied since Transair's inception in 1947, has been closed down and replaced by a brand new £250,000 administration and maintenance facility. Unlike most independents' bases—with the notable exception of Silver City's Ferryfield—this one displays the enviable advantages of having been planned from the start as a place of airline business. It was designed by Clive Pascall and Peter Watson of London, and was built by McAlpine.

The site chosen is roughly an equal taxying distance to the terminal area and to the runway. [It was probably no accident, too, that the building is prominently noticeable from the London - Brighton road and the adjoining railway.]

The new office building houses all the administrative personnel, and the adjoining hangar—which accommodates two or three aircraft at a time (depending on whether they are Viscounts or DC-3s)—houses the engineering staff. The various engineering offices (hydraulics, electrics, stores, etc.) are clearly placarded, and lead directly off the floor of the hangar. Total Transair staff is now about 400.

An innovation (described in Straight and Level on page 825), is the Viscount maintenance "dock"—which is not a dock at all, but a hydraulically operated system of retracting pits under each wheel. A picture appears on the previous page.

Transair's Viscount maintenance was, until the move to Gatwick, carried out by B.E.A. at London Airport, with Transair's Viscount engineers (16 of whom are now checked out on the aircraft) looking on. Transair are appreciative of the help given to them by B.E.A., and can no doubt be of return help pending the time when B.E.A. have their own facilities built at Gatwick. (A site alongside Transair's base, separated from it by a massive earth blast-wall and marked by a "Fly B.E.A." board, has been reserved for the Corporation.)

Transair's Viscount engineers have developed, with A.R.B. approval, their own maintenance schedule. It is of the pictorial kind, as pioneered for the 700 by Field Aircraft Services.

Transair seem to be getting good utilization out of their fleet: having recently added a third Viscount 804, it might have been expected that some DC-3s would have been disposed of. In fact, one more DC-3, making 11 in all, has just been acquired from the R.A.F.

Each Viscount is utilized at a rate which is approaching an annual 2,500 hr. About a half of these hours are on trooping (to Gibraltar, Malta and Idris), and the rest on inclusive-tour summer holiday services (five a week) to Gibraltar, Tangiers, Toulouse, Palma and Nice. In addition, though this is not widely known, Transair have a contract with Air France to operate daily Viscount flights between London, Paris and Nice. Air France cabin staff are carried, and the contract extends from May to October, 1958.

The airline's DC-3s achieve about 2,000 hr a year each, and are used for daily newspaper deliveries to the Continent; internal services in Germany; inclusive-tours (to Alghero, Perpignan, Pisa, Minorca, Lourdes); general charter and freighting; and Transair's one normal scheduled service—from Gatwick to Jersey. This operates from June until September, with one flight on Fridays and six on Saturdays.

Transair now have 68 pilots: 23 DC-3 captains and 23 first officers, and 22 Viscount captains and first officers.

The main impression gained from a recent *Flight* visit to Transair's new Gatwick base is that new quarters—especially when they have been planned and paid for by yourself—provide something more than better working conditions. They do something to enhance morale too, however good this may have been in the past.

The scene inside Gatwick's new terminal on the day of its Royal inauguration, June 9, 1958.

Celebrating the inauguration of Continental Air Lines' Viscount services between Chicago, Kansas City, Denver and Los Angeles are seen (from l. to r.) Mr. Norman C. Geiger, Continental's Los Angeles sales manager; Ethel Merman, wife of Mr. Bob Six, Continental's president; Capt. R. Rymer, senior Vickers experimental test pilot; and Mr. Christopher Clarkson, Vickers' U.S. representative. The picture was taken in Los Angeles.

HANDS ACROSS THE HIMALAYAS

IN New Delhi on June 2 a bilateral air agreement for a Moscow - Delhi air service was signed between Russia and India. The signatories were Marshal P. Zhigarev for the U.S.S.R., and Mr. M. M. Philip, secretary of the Ministry of Communications of the Government of India. The agreement came into force immediately. The specified route is Delhi - Amritsar - Tashkent - Moscow, but Aeroflot and Air-India may overfly the intermediate airfields at their discretion. Initially, Aeroflot are authorized to carry international passengers, cargo and mail to and from Amritsar and Delhi, and Air-India to and from Tashkent and Moscow.

Aeroflot's Tu-104s, which will serve this route, will show a big advantage in speed over Air-India's Super Constellations. The Tu-104 service is scheduled to take 8½ hr and the L.1049G three or four hours longer. Each airline will operate at an initial frequency of one service per week and will offer first- or tourist-class seats.

It was agreed also that each party would bear its own expenses in operating the service, but the revenue would be paid into a common pool. At the end of each calendar month the fund will be apportioned on a basis of the number of scheduled and non-scheduled services operated by each airline during the month.

ELECTRONIC CUSTOMER-SERVICE

IN our issue of June 6 we discussed the background to the recent meeting of 33 Viscount operators at Vickers-Armstrongs' Weybridge works—a demonstration of after-sales service in its most advanced form. At the other end of the scale of customer-service is pre-sales technical effort; at Weybridge this is largely the responsibility of the civil aircraft development group, an organization which can fairly claim to be the most experienced and effective of its kind outside the U.S.A.

Even if it were Vickers' sales policy to deal merely with customers' inquiries, which it is not, the volume of work involved would be considerable. The variety of Viscounts and Vanguards being marketed is wide, and the demand from operators wanting to know how these aircraft match up to their particular require-

ments is steady. But the successful selling of airliners, even by firms with well-established products, is not wholly a matter of dealing with inquiries: openings have to be sought, investigated and followed up hard and quickly.

The days when a route-analysis might take two men two weeks to prepare are—at Vickers at any rate—long past. While key technicians are thus tied up, other work goes by default; it is difficult satisfactorily to handle inquiries, let alone positively to encourage them by creative selling. The answer, Vickers found, was automation: and about 18 months ago a Ferranti Pegasus electronic computer was acquired for the mathematical services department at Weybridge. This equipment has enlarged the civil aircraft development group's capacity to an almost immeasurable degree—immeasurable because the group's output now includes work which it could not previously have even considered attempting. To be able to run off, in one afternoon, detailed capabilities of the Viscount 810 on 150 routes of a particular U.S. operator —as was recently done—provides some measure of the group's increased scope. Such a task, accomplished manually, would take weeks. The possibility of being able to call on an airline at 24 hours' notice with a detailed study of the Viscount or Vanguard on that operator's routes is now a workable proposition. Though airlines may take months to decide to buy new equipment, they are nevertheless strongly influenced by a manufacturer who can give them fast and efficient pre-sales service.

Pegasus is a digital computer, and probably one of the most popular British machines of its kind in service. Vickers' machine is now used till 8 p.m. or 9 p.m. five days a week, which leaves considerable capacity (night-shift and week-end) still in hand. Generally speaking, mornings are devoted to scheduled maintenance and programme testing, and the afternoons and evenings are spent on production. Input and output are in coded punched-paper tape form: the final decoded result comes from the teleprinter as a neat, foolscap-sized sheet.

About 40 per cent of the computer's time is devoted to route-performance or cost analyses. The group has programmed the capabilities, weights and performance of all Vickers' civil aircraft variants, in a way which takes care of any operator's foreseeable requirements—C.A.A. or B.C.A.R. performance rules, varying operating techniques, and so on. This part of the input into the computer provides the instructions (up to 36 items) and is followed by the applicable route data—headwinds, runway data, temperatures, etc.—about 30 items in all. As teleprinted, the output records for good measure the basic data assumed and presents the final route analysis in the form of take-off and landing limitations, sector-segment times, fuel consumed, speeds (to make sure V_{NO} is not exceeded), and appropriate weights.

Other uses to which Pegasus is put by the group are numerous. For example: (1) operating techniques can be optimized to produced minimum operating cost; (2) compilation of Operations Manual data can be done more quickly; (3) investigation of the effect of particular modifications on performance can now be more readily assessed.

Much call is made on the computer's time by Vickers design departments. Typical of the work recently done are: pressure distribution analysis of the VC.10's wing, and the calculation of lift, drag and moment coefficients for different incidences; estimation of VC.10 wing, tail and fuselage loads at varying speeds and heights, a five-hour computer job which, previously done manually, required 70 pages of output from three pages of information.

BREVITIES

PREVIOUSLY exempt from the scrutiny of the Air Transport Advisory Council, applications to operate circular tours by air must now receive Council approval. This is because of the similarity of some proposals to inclusive tour services.

* * *

A Tu-104 is expected to attend the British Columbia centenary celebrations.

* * *

Britavia announce that Mr. W. E. Hogsflesh, A.F.R.Ae.S., general manager of the company, has been elected to the Board.

* * *

At Paris-Orly U.A.T. are to construct one of the biggest hangars in Europe. Capable of housing three DC-8s, it will be 525ft long, 117ft wide and 60ft high.

* * *

An aircraft of American Airlines reported a near miss from a military trainer near St. Louis on June 10. Four passengers and two stewardesses were slightly injured as a result of evasive action by the pilot of the transport.

* * *

Because of the cost of overhaul of T.E.A.L.'s Solent and a lack of modern navigational aids, the Coral Route service between Fiji, Western Samoa and the Cook Islands is to be discontinued in August.

* * *

A new Dutch firm, the International Charter Aviation Company, backed by British, Dutch and German capital, has been formed to operate tourist charter services in Europe and across the Atlantic. There will be a tri-national management and the fleet will consist of three Vikings. Next year it is planned to operate Ambassadors.

Eagle Airways are offering a dictaphone service to businessmen on their Brussels, Frankfurt, Hamburg and Copenhagen services.

* * *

The Gibraltar - Tangiers service was jointly operated by Gibraltar Airways and Royal Air Maroc as from June 15.

* * *

A DC-6 of Aerolineas Argentinas, with 16 passengers on board, was totally destroyed after a forced landing in four feet of water near Rio de Janeiro on June 10. Seven people were injured. This was the airline's first DC-6 mishap in ten years.

* * *

Ozark have been evaluating the Viscount 790, Caravelle, Allison-Convair and F.27 as replacements for their present DC-3 fleet. A decision is expected shortly.

* * *

In the first four months of this year Icelandair carried 57 per cent more passengers (total 4,372) than in the corresponding period of 1957.

* * *

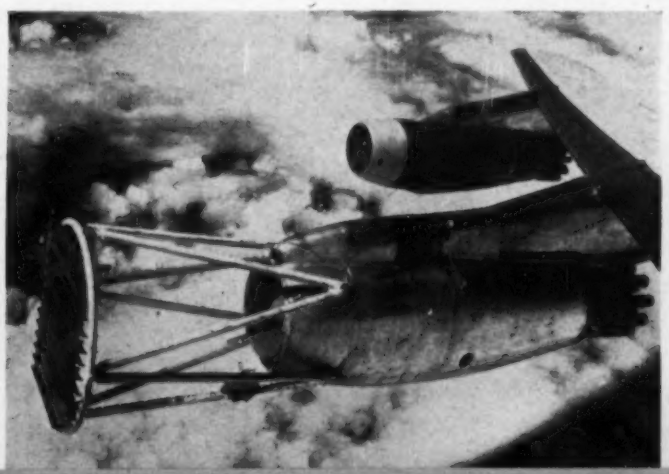
S.A.S. have increased their Caravelle order from six to 12, making a total of 32 Caravelles now sold. They retain an option on 13 more.

* * *

A Britannia 305—G-ANCD, in Cubana colours—was recently demonstrated in Madrid to officials of Iberia and later to government and airline officials in Portugal. The secretary-general of Iberia, Snr. Juan Viniegra, said that "the demonstration left a memorable impression, but at the moment the acquisition of Britannia aircraft does not enter into our plans." The aircraft flew on to Cuba *via* the Azores.

Despite meat-strike pickets at Southend Airport, Air Charter's Bristol 170s have brought at least 500 tons of meat from Rotterdam in the last few weeks.

As part of the C.A.A. certification programme, the original 707 has recently been carrying out flight tests to determine the de-icing capabilities of the J57 powerplant. The inboard pod, seen with its spray-rig, is the production version.



Popular Flying Weekend

THE P.F.A. RALLY

THIS year's Popular Flying Association rally was a less competitive occasion than the event held at Sywell in 1957. Much as the entrants then had enjoyed dashing around the countryside visiting as many aerodromes as possible, the accumulated fuel bills had been formidable, and for the P.F.A. rally last weekend the Association chose Rhoose Airport at Cardiff as the venue, and the more hedonistic pleasures of a *vin d'honneur* as part of the competitions.

A feature of these rallies is the participation of the French Reseau du Sport de l'Air. But thanks to the wait for the contingent from France to arrive, lunch became a rather protracted affair which some bottles of wine seemed to help along. . . . So there should be *vin d'honneur* next year; and in any case the French kept winning bottles of whisky in the *concours d'elegance* held on the Saturday afternoon. The trim lines and beautiful finish of the Jodels and Emeraudes quite outshone the competitive efforts of P.F.A. members with admittedly much older aeroplanes; and from a total of 39 competing aircraft, the seven French entries carried off the first three places in the *concours*. First prize went to M. Baritault in his Minicab F-PHUC (M. Baritault was a winner at the P.F.A. week-end last year); runner-up was M. Vieux with Emeraude F-BIAY; and M. Francis Couesnon's Emeraude was placed third. The best P.F.A. group aircraft was Birch's Argus G-AJOZ, from the Warwickshire Aeroplane Club, and Mrs. Joan Short's white Turbulent G-APIZ was highly commended. More booty from South Wales (bottled in Scotland) was carried off to France by M. H. Sornin, who won the arrival competition.

A dinner and dance was held in Cardiff in the evening, and the following morning the P.F.A. president, Mr. Peter Masefield, flew to Rhoose to attend the rally. Last year he commented on the sad lack of home-built British light aircraft, and although few are yet in evidence, several are under construction. The Rutherglen Flying Group's Turbi is proceeding quite well and, apart from a few details, the de Havilland Aeronautical Technical School's Turbi is nearly complete. Also announced at Cardiff (as in *Flight* a month ago) was the Crusader, an all-metal, low wing, side-by-side two-seater with a tricycle undercarriage that is being constructed by Condesco, Ltd., of Clock Chambers, London Road, Enfield. The firm intend to produce comprehensive plans (Turbi plans leave a good deal to the imagination) for amateur constructors.

French-designed aircraft figured prominently at the P.F.A. rally. Here are the Tiger Club's Turbulent and Emeraude F-BIMG.

ELSTREE AT HOME

LAST Saturday, on the same day as the P.F.A. rally, Elstree Flying Club held their annual At Home. The French contingent to the rally, by lunching at Elstree, almost managed to attend both events, an operation also attempted by *Flight's* representative, who lunched at Rhoose before flying on to Elstree to watch a crowded afternoon of display events. There were a few changes in the programme and, sad to relate, the Mercury engine of the newly reconditioned Gloster Gladiator was running too roughly for the aircraft to appear. But an exciting surprise item was a fly-past by the Comet 4 and the remainder of the display ran with commendable despatch, amply fulfilling the expectations of the large crowd that had surmounted the bus strike to attend. Present in an unofficial capacity was the Under-Secretary of State for Air, Mr. Ian Orr-Ewing, who came to Elstree after opening a local fête.

A demonstration of the vintage Comper Swift G-ABUS, a tied-together Tiger formation (including a landing on Elstree's fairly narrow runway), a Magister race, an excellent delayed-drop parachute jump with a landing in front of the public enclosure and a really lively Chipmunk party-piece by David Ogilvy and Bill Bailey were among the varied bill. There is bound to be exciting flying when the Tiger Club are airborne, and a display of "Bishopbatics" and "Tigertactics"—the latter a Tiger race ending in a suspiciously close line-abreast finish after Beverley Snook had gained a substantial lead—were among the high spots of a spirited afternoon.

PLYMOUTH DISPLAY

SET under high blue skies scarred by a Victor's contrail, the Plymouth air display on June 14 at Roborough, home of Plymouth Aero Club, was attended by over 10,000 spectators.

As Air Marshal Sir Philip Wigglesworth (retd.) opened the display, in from the west came the maroon and cream Jet Provosts of the C.F.S. led by F/L. N. H. Giffen. They put on a show of formation changing and aerobatics that set the pace for the afternoon's events.

The Gannet is no stranger to the Naval base at Plymouth, and 796 Squadron from Culdrose put their mounts through the usual Gannetry circus of fast and slow runs, all up or all down, with zest and immaculate formation-keeping. The next event was flown by W. Lucas and P. Cleife in the pupil-and-instructor act, the faltering mishandling of one Tiger compared with the effortless, polished flying of the other being a delight to see. A Hunter demonstration of high-speed aerobatics, a Dragonfly demonstration by Culdrose's Air Rescue Flight, and a five-Tiger Moth formation event led to a display of precision aerobatics by four Sea Venoms of 809, whose formation-keeping was of the highest standard. Making its début at a West Country display was a Shackleton MR.3 from 220 Squadron, which made several low passes before leaving the circuit clear for what was unintentionally the highlight of the afternoon. Climbing to 3,000ft were two Tiger Moths carrying parachutists Peter Lang and Peter Lucas to make a delayed drop. There was a pause between the two jumps. Lucas's parachute opened after about 12 to 15 secs, but Lang continued on, and not until he reached 800ft did he release his canopy, to a sigh of relief from everyone watching. It was only later that it was learned that Lang's timing device had jammed after 12 secs, and it was seconds before he realized what had happened.

Still airborne in his Tiger, W. Lucas then dived in to give a crazy flying display, and a beautiful piece of silent aerobating was performed by G. Collins in an Olympia of the Cornish Gliding Club, culminating in a sibilant swish over the spectators. The final flying event—F/L. Phillips in a Vampire T.11 of the C.F.S.—brought forth superlatives from even the most hard-bitten air display enthusiast.

Below, left, Gannets of 796 Squadron, Royal Navy, perform at the Plymouth display at Roborough. (Below) At Elstree's At Home were (l. to r.) G/C. Eustace Miles (Association of British Aero Clubs) and Messrs. David Ogilvy (Elstree's manager), Ron Paine (Derby Aviation) and L. W. Farrer, who is a private owner at Wolverhampton.

In service with the Royal Air Force

Two years service with the Royal Air Force has established the Jet Provost ab initio/basic trainer as the best aircraft for its purpose, and the Mk. 3 powered by one Armstrong Siddeley Viper Turbo Jet is now in production for the re-equipment of Flying Training Command.

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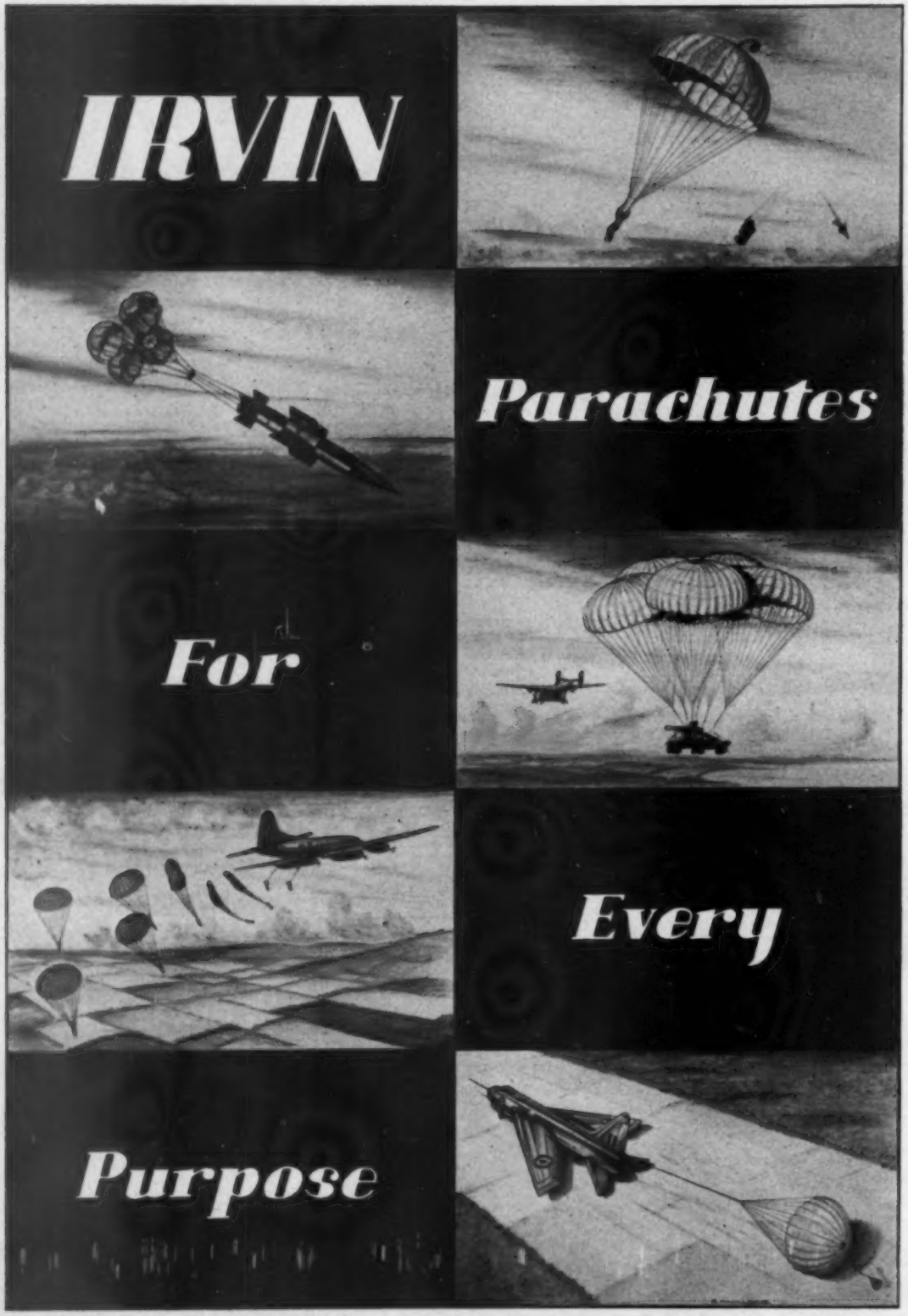

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A "FLIGHT" SPECIAL REVIEW OF THE MOST SIGNIFICANT TYPES

GREAT BRITAIN — FIGHTERS AND FIGHTER-BOMBERS

Armstrong Whitworth (Hawker) Sea Hawk Mks 100 and 101 These latest (German) versions of the Sea Hawk fighter/bomber are derived from earlier marks, as supplied to the Fleet Air Arm and the Dutch Government (photograph below). They are characterized by revised vertical tail surfaces and by differing items of equipment. Both marks have provision for four pylon-mounted auxiliary tanks and the Mk 101 carries a greater load of electronic equipment. A possible Sea Hawk armament combination is two 500 lb bombs and rocket projectiles, in addition to two 75-gal auxiliary tanks. Standard built-in armament is four 20 mm guns. The Rolls-Royce Nene turbojet is invariably fitted.
Span, 39ft; length, 40ft.

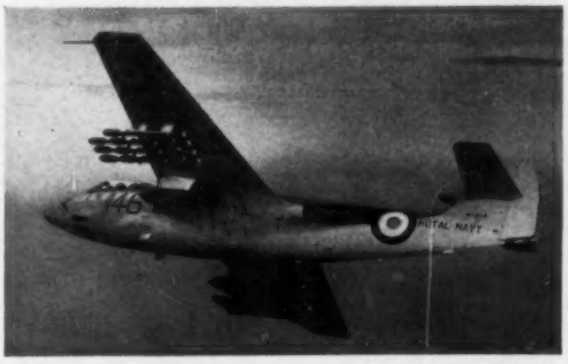
de Havilland Sea Vixen FAW.1 As now in production for replacement of the Sea Venom, the Sea Vixen FAW.1 two-seat all-weather carrier-borne fighter (two Rolls-Royce Avon) carries no gun armament. Underwing provision is made for four D.H. Propellers Firestreak guided missiles, and there are retractable fuselage packages, made by Microcell, for 28 2in spin-stabilized air-to-air rocket projectiles. Loads displayed with a Sea Vixen at the last S.B.A.C. Show were four Firestreaks and two tanks; four 500 lb bombs and two tanks; two bombs, two Firestreaks and two tanks; two tanks, two bombs and two clusters of six rockets each; two tanks and four clusters of rockets; or four bombs and two clusters of rockets. This display emphasized the potentialities of the Sea Vixen in the strike rôle. The pilot's cockpit canopy is offset to port, behind the massive pointed radar nose section, and the observer is housed entirely within the fuselage to starboard. Both occupants have Martin-Baker Mk 4 lightweight ejection seats. In order to meet Naval requirements the Sea Vixen has been very largely redesigned from its precursor the D.H.110, though all essential features of the original layout are retained. Supersonic speed is attained in a shallow dive.
Span, 50ft; length, 53ft 6½in.

English Electric P.1B A very detailed description of this twin-Avon supersonic single-seat all-weather intercepter, together with an exclusive sectional drawing, appeared in *Flight* of January 10 last. The aircraft was shown with its main armament of two D.H. Propellers Firestreak air-to-air missiles on lateral pylon mountings, and with two 30 mm Aden guns installed high in the fuselage with their barrels flanking the cockpit. Potentially capable of speeds of over Mach 2, the P.1B has an extremely high service ceiling and rate of climb, especially when a Napier Double Scorpion twin-barrelled rocket motor is installed in the ventral fairing with which prototypes have been flying for many months. In March last it was disclosed that the P.1B had already been flying at speeds in the region of the world's air speed record (then standing at 1,207 m.p.h.). During the same month it was officially announced that the "performance" of the aircraft would be improved by "electronic computing equipment to tell the automatic pilot the place in which to intercept the bomber."
Span, 34ft 10in; length, 50ft.

Folland Gnat Mk 1 Production of this light fighter/bomber is building up rapidly. Built-in armament is two 30 mm Aden guns, each with 150 rounds, which is sufficient for about six seconds' firing. Possible external loads are two bombs and two drop tanks; two drop tanks and rocket projectiles; 12 rocket projectiles and no drop tanks; and a drop tank and a camera pod, the latter carrying three F.95 cameras under the starboard wing. Cabin pressurization starts at 15,000ft and maximum differential is 3½ lb/sq in at 40,000ft and above. Standard equipment is one multi-channel V.H.F. transmitter/receiver, with single-channel stand-by and tele-briefing, radar ranging, I.F.F. and a radio compass or other navigation aid. A new pattern of 66-gal drop tank has been developed and the aerodynamic shape has been test-flown and proved to be buffet free up to sonic speed. The engine is a Bristol Orpheus.
Span, 22ft 2in; length, 29ft 9in; gross weight, 6,200 lb; max. level Mach number, 0.98.

Gloster Javelin FAW.7 and 8 These most recently announced marks of the Javelin two-seat all-weather fighter will have reheat for their two Armstrong Siddeley Sapphire turbojets, the rear end of the fuselage being redesigned accordingly. In recent weeks it has been disclosed that two Microcell packs of 37 2in unguided rockets, behind a frangible plastic nose cone, have been added to the armament of the FAW.7. In addition the aircraft carries two D.H. Propellers Firestreak missiles on the outboard pylons, and two 30 mm Aden guns in the wings. An alternative armament is four Firestreaks. Having examined an FAW.7 at the S.B.A.C. Display last year, *Flight* reported that it was evident that this mark had been extensively re-engineered both in structure and equipment. Increased wing tankage is a feature. Stall warning indicators and duplicated q-feel systems have been installed; the Armstrong Siddeley Sapphires are of higher thrust than those of earlier versions; and the fire control radar is of a more recent pattern.
Span, 52ft; length, 56ft 4in.

Above, Blackburn NA.39 (see page 836). Below, A.W. Sea Hawk.



Hawker Hunter F.6 This current-production mark of the Hunter fighter/bomber (Rolls-Royce Avon) was described and illustrated in great detail in *Flight* of May 9 last. Performance details have not been divulged, but the aircraft is supersonic in a shallow dive. In our appraisal of the aircraft it was remarked, "Its severest test to date, and one from which it emerged with flying colours, was the comprehensive evaluation carried out by the Swiss Air Force during the summer of last year. French, Canadian, American and even the indigenous Swiss design specially prepared for Alpine conditions were bettered by the remarkable all-round qualities of the Hunter F.6, both as a fighter and as a ground-attack machine; and although it still ranks as a day fighter in many air forces, it has also undoubtedly proved itself to be the finest ground attack aircraft at present available anywhere in the world. As a gun-platform, as a carrier of stores and as a pilot's aircraft it outperformed and outgunned any other type the Swiss were considering at the time. Its cost is also remarkably low—thanks to the fact that it is right down at the bottom of its 'learning curve.'" Numerous armament combinations are possible in addition to the four 30 mm Aden guns. They include two 1,000 lb bombs plus 24 3in R.P.s; and two 37 × 2in R.P. (or honeycomb packs) in addition to four Oerlikon, Bofors or Hispano rockets and launchers.
Span, 33ft 8in; length, 45ft 10in.

Vickers-Supermarine Scimitar F.1 The Scimitar will replace the Sea Hawk as the standard day fighter/bomber/ground attack aircraft of the Fleet Air Arm. It is powered by two Rolls-Royce Avons and has a built-in armament of four 30 mm Aden guns. A tactical nuclear bomb is a possible load. Even when carrying the nuclear store and a drop tank the Scimitar will be able to "sprint" into the target at low level

at nearly Mach 1. The machine is enormously strong to meet this low-level strike case, and the design diving speed is supersonic at sea level. An economical cruising speed of about 400 kt would generally be used and the "loiter" time can be extended by shutting down one engine. The flaps have super-circulation, air from the engine compressors being tapped off at the final stage. This air is ducted to play over the top surface of the flaps via a full-span slot, and is controlled by the normal flap lever. The "blow" comes on after 5 deg of flap extension, but a further switch is provided to cancel this facility when not required. A new navigating system will increase effectiveness in the strike rôle, and an "alternative armament" will enhance air-to-air fighting capabilities.

Span, 37ft 2in; length, 53ft.

RECONNAISSANCE

Avro Shackleton MR.3 The MR.3 is the current production version of the Shackleton (four Rolls-Royce Griffon engines). Its armament is two 20 mm guns in the nose, and the weapons bay, of exceptionally large dimensions, will carry numerous combinations of bombs, homing torpedoes, mines, flares, etc. In the anti-submarine rôle the Shackleton is equipped to detect, track and attack. Initial long-range detection is by means of tactical searches and patrols, and in homings by radar and other special equipment on to buoys, ships, snorting submarines and aircraft. Accurate fixing and short-range tracking of submarines is carried out using sonobuoys; and day and night attacks with torpedoes or depth charges complete the operational sequence. The crew numbers ten—two pilots, two navigators, a flight engineer, a radar operator, R/T. operator, two sonics equipment operators, and beam look-out.

Span, 120ft 6in; length, 87ft 4in.

Above, Folland Gnat Mk 1 with two 500 lb bombs and two 66-gal tanks.

Below, Hawker Hunter F.6.

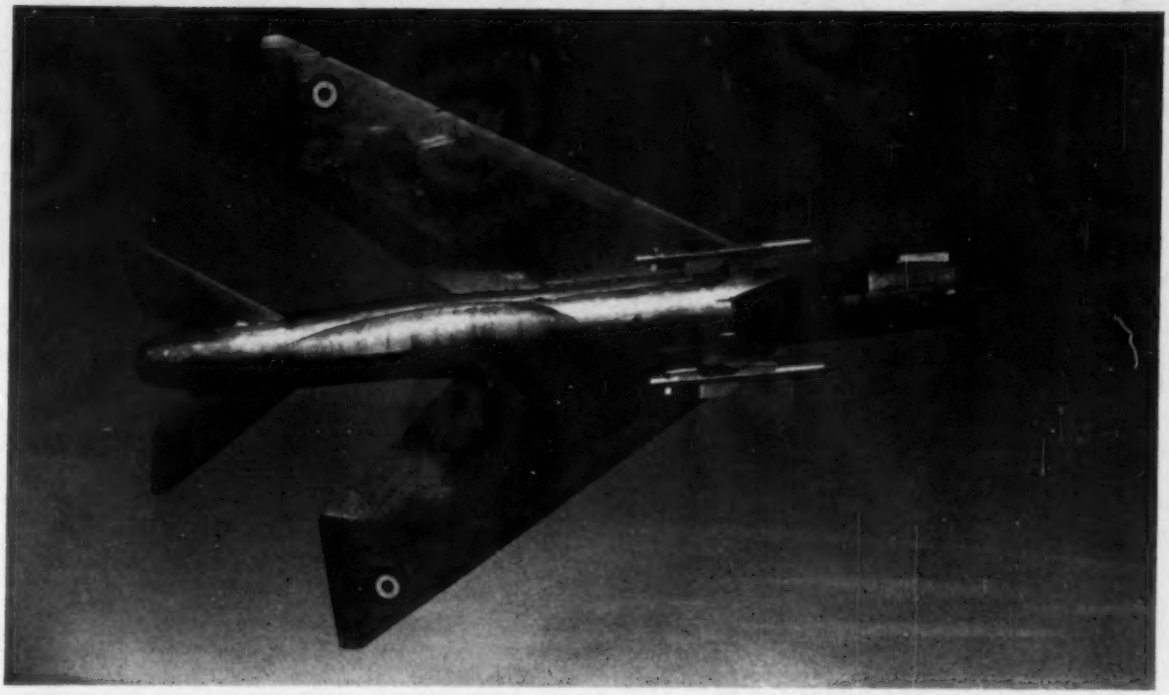
English Electric Canberra PR.9 Now in production for the R.A.F. at the works of Short Brothers and Harland, Ltd., this ultra-high-altitude Canberra has advanced Rolls-Royce Avon turbojets, increased span and deepened centre-section chord, and offset canopy.

Span, 68ft; length, 66ft 8in.

Fairey Gannet AEW.3 Intended as an early-warning aircraft to replace the Royal Navy's Douglas Skyraiders, this mark of the Gannet, now in production and soon to fly, is a very different aeroplane from either the anti-submarine or operational trainer Gannet. The second and third cockpits have been deleted, the tail is of new design, and there is, of course, the massive ventral AEW. radar housing.

Fairey Ultra-Light Although suitable for multiple military applications, the Ultra-Light is mentioned under this heading because particular interest has lately been shown in the practicability of operating reconnaissance helicopters of this class from small ships. An Ultra-Light has in fact been flown from a Naval craft in exceptionally rough Channel weather. More than 70 landings and take-offs were accomplished in winds measured on the bridge at 62 kt with the deck pitching 10-12ft and rolling up to 14 deg in each direction. The Ultra-Light is powered by a Blackburn Turboméca Palouste turbine.

Below, de Havilland Sea Vixen FAW.1.



Above, English Electric P.1B.

Below, Gloster Javelin F.A.W.7 (development prototype).

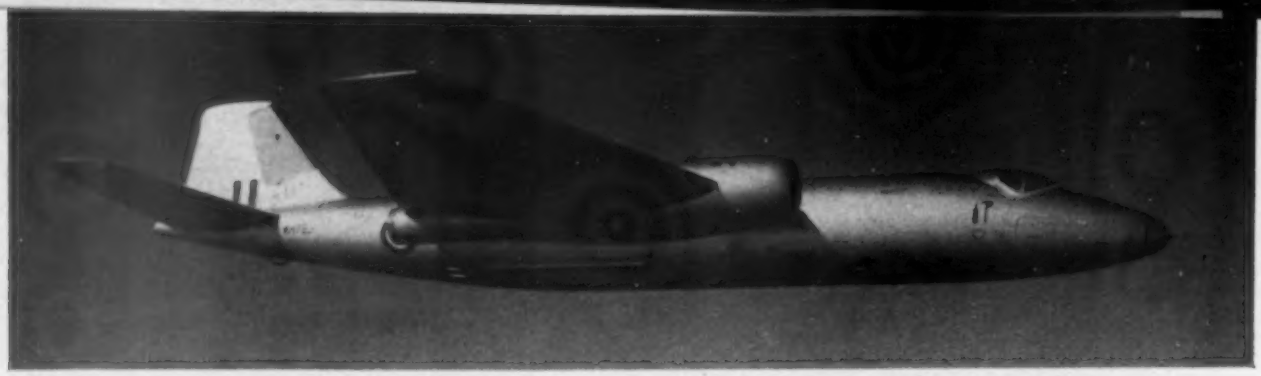
Above, Vickers-Supermarine Scimitar F.1.

BOMBERS AND STRIKE

Avro Vulcan B.1 The B.1 version of the Vulcan (Bristol Olympus) continues in production for R.A.F. Bomber Command and has put up some outstanding long-distance performances in recent months. It has been stated that this mark has been successively fitted with the Olympus 101, 102 and 104, rated at 11,000, 12,000 and 13,000 lb thrust respectively. A picture on page 852 shows a Vulcan B.1 carrying the new Avro stand-off bomb, which is likely to become a standard store for all marks of Vulcan and other V-bombers. Provision is made for probe-and-drogue flight refuelling. Ceiling is known to be in excess of 50,000ft, and reconnaissance capabilities are obvious.

Span, 99ft; length, 97ft 1in.

Avro Vulcan B.2 No actual example of this improved Vulcan is yet flying, but the aerodynamic prototype is characterized by a considerably larger wing than that of the B.1 and production machines will have



English Electric Canberra PR.9. (The aircraft depicted is the prototype. Production aircraft will have an offset cockpit canopy.)

Military Aircraft of the World . . .

Olympus 200-series turbojets. Near-sonic speeds are frequently attained by Vulcan B.1s at 50,000ft and higher, and the performance of the B.2 is expected to show a marked improvement.
Span, 111ft.

Blackburn and General Aircraft NA.39 A very detailed discussion of this new British carrier-borne low-level strike aircraft (see page 833) appeared in *Flight* of May 9. It has been designed to operate from such ships as the *Victorious*, *Eagle* and *Ark Royal*. A crew of two is carried, with sufficient equipment for all-weather operation. A very varied range of armament stores and tanks, including a variety of nuclear weapons, might be stowed internally and externally, and it is thought that the radius of action is at least 500 nautical miles. Cruising speed might be of the order of Mach .9, and the structure is stout enough to permit operation at high indicated speeds at low altitudes. The power units are two de Havilland Gyron Juniors, without afterburning, and a supercirculation system for the wings and flaps may be employed.

English Electric Canberra B(I).8 The first full description of this bomber/intruder (two Rolls-Royce Avon) appeared in *Flight* of March 14. There is a Boulton Paul 4 × 20 mm gun pack and possible stores include six 1,000 lb bombs or mines. A visual bomb-sighting station is located in the nose, but Canberra B(I).8 squadrons are now practising the automatic LABS method of delivery for nuclear weapons.
Span, 64ft; length, 65ft 6in.

Handley Page Victor B.1 This mark of Victor is entering service with R.A.F. Bomber Command this year. In addition to the very large fuselage bomb bay, which has multi-plate deflectors ahead of the doors, provision has been made for under-wing bomb containers. The four Armstrong Siddeley Sapphire turbojets are reported to be of the ASSa.7 series. It has been claimed that an aircraft of this mark has exceeded the speed of sound, in a dive, by some 15 m.p.h.
Span, 110ft; length, 114ft 11in.

Handley Page Victor B.2 Four Rolls-Royce Conway RCo.11 by-pass turbojets, each delivering a thrust of the order of 17,250 lb, are specified for this much improved mark of Victor. A notable increase in all-round performance is expected.

Hawker P.1121 Work on this low-level strike aircraft has not been stopped although it is proceeding at a very much reduced rate. Speed would probably be of the order of Mach 2.

Vickers-Armstrongs Valiant BK.1 This mark was the last of the Valiant series (production ceased last August). All Valiants in R.A.F. service can be modified to supply or receive fuel in flight. A large number of standard machines were, in fact, completed with the basic fittings for the tanker or receiver rôles, and can be converted to tankers in a matter of hours. The receiver conversion, which involves only the fitting of a probe, can be made within minutes.
Span, 114ft; length, 108ft 3in.

ANTI-SUBMARINE

Fairey Gannet AS.4 This version of the Gannet is almost identical with the earlier AS.1 but has a more powerful version of the Armstrong Siddeley Double Mamba turboprop. A possible load is two homing torpedoes, the external characteristics of which were clearly seen in a photograph of a German Gannet published in *Flight* of May 30. Other loads are sixteen 60-lb R.P.s; six Mk 2 depth-charges; ten sonobuoys; two fuel tanks; two mines; four flares; several 250 lb bombs; four sea markers; and A.S.R. packs. Although the Gannet has been in service for a lengthy period it is still the most advanced machine of its class in the world. The Gannet T.5 provides advanced training in weapon technique and engine handling.
Span, 54ft 4in; length, 43ft.

Westland Whirlwind HAS.7 This is the standard anti-submarine helicopter of the Royal Navy and its functions were discussed in *Flight* of May 2 last. The engine is an Alvis Leonides Major derated to 750 h.p. With this engine the Whirlwind carries either sonar detection equipment or a homing torpedo at an all-up weight between 7,000 and 7,800 lb. Radar-reflecting surfaces are fitted to the main undercarriage legs for improved identification of the helicopter by parent ships or shore stations.

Westland Wessex Primarily intended for anti-submarine work with the Royal Navy (though also suitable, like the Whirlwind, for rescue, communications, casualty evacuation, etc.), the Wessex is powered with a Napier Gazelle free-turbine engine. Provision is made for search equipment, such as asdic, and a transparent floor panel enables the detector head to be viewed when in use. The whole gear is rapidly dismountable and easily removed through the cabin door. When asdic is carried fuel tankage is 260 gal. Provision is made for carrying weapons in containers, which may be heated if necessary.

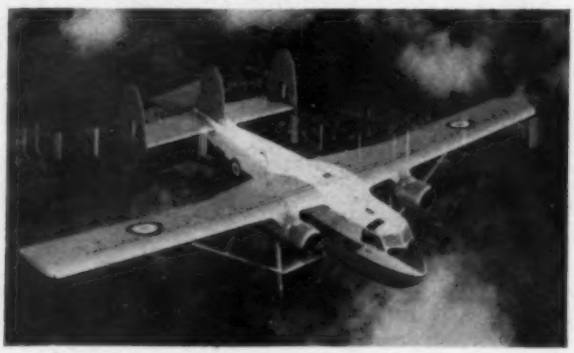
TRANSPORTS

Blackburn and General Aircraft Beverley C.1 In R.A.F. exercises this transport (four Bristol Centaurus piston engines) has rendered an excellent account of itself, notably through its ability to operate from confined areas under arduous tropical conditions. A load of 29,000 lb of steel plate and other ballast has been dropped during tests by eight G.Q. parachutes each 66ft in diameter.
Span, 162ft; length, 99ft 5in; gross weight, 143,000 lb; max. speed, 238 m.p.h. at 5,700ft.

Blackburn B.107 This designation applies to a projected development of the Beverley powered with four Rolls-Royce Tyne turboprops, having a retractable undercarriage and revised fuselage. Cruising speeds well in excess of 300 m.p.h. should be reconciled with short-field performance and a longer range than that of the Beverley.

Bristol Type 192 The first example of this twin-rotor helicopter, powered by two Napier Gazelle gas turbines and intended to become

Left, Fairey Gannet AS.4. Below, Scottish Aviation Twin Pioneer.



WHAT THEY SAY ABOUT THE GAZELLE

...the first to ... scale production—made a silent debut at Yeovil, Somerset, yesterday. It's the quietest helicopter I have seen (writes Gilbert Cartes)...

...Watching his spirited manoeuvring with it, it was difficult to realise that this prototype has only had two hours 51 minutes flying. It was a measure of the complete confidence in this new turbine engined development...

...normally it takes about ten minutes for a piston-engined helicopter to warm up for take-off after the engine has been started, but in this case the aircraft was airborne in well under one minute...

...It flew upwards, downwards, backwards, turned, and even pranced like a horse.

Westland's chief test pilot, ex-Fleet Air Arm Lieut. "Slim" Bear, said: "I had a new observer, and the engine was so quiet he thought it had stopped."

He said its gas turbine Napier gave Britain the lead in this type of engine.

The new heli-jet is silent

By Daily Mail Air Correspondent

BRITAIN'S first production jet helicopter, the Westland Wessex, was demonstrated ...vil, Somerset, yesterday.

He said its gas turbine Napier Gazelle gave Britain the lead in this type of engine.

The plane has been ordered in quantity ...

When the Westland "Wessex" first flew at Yeovil, the air correspondents of the National Press were unanimous in their praise of the aircraft and particularly of the engine powering it: the Napier free-turbine Gazelle.

ITS SILENCE External noise has been reduced by more than half compared with that of a piston-engined helicopter: an important step toward the reality of city-centre to city-centre air transport. Inside the cabin the engine is almost inaudible.

ITS TAKE-OFF The Wessex can take off in less than half a minute from engine start, and its rate of climb has been described as 'remarkable'. This is a valuable asset in emergency. In addition, the engine can be operated at 30% above its normal maximum power output for short periods.

ITS REVOLUTIONARY DESIGN **The Gazelle is eminently suitable for helicopter work because it is both light and tough. Without clutches, etc., the free-turbine arrangement takes pounds off the weight of the transmission mechanism. At the same time it is planned to give long service between overhauls and, because of the unique 'unit' method of construction, repair time is cut to a minimum.**

The Gazelle marks an epoch in helicopter design as significant as the change-over from piston to jet engine in fixed-wing aircraft. Everyone interested in the future of British aircraft should know about it. Write to D. Napier & Son Ltd. London, W.3 for more details.

NAPIER GAZELLE FREE TURBINE ENGINE

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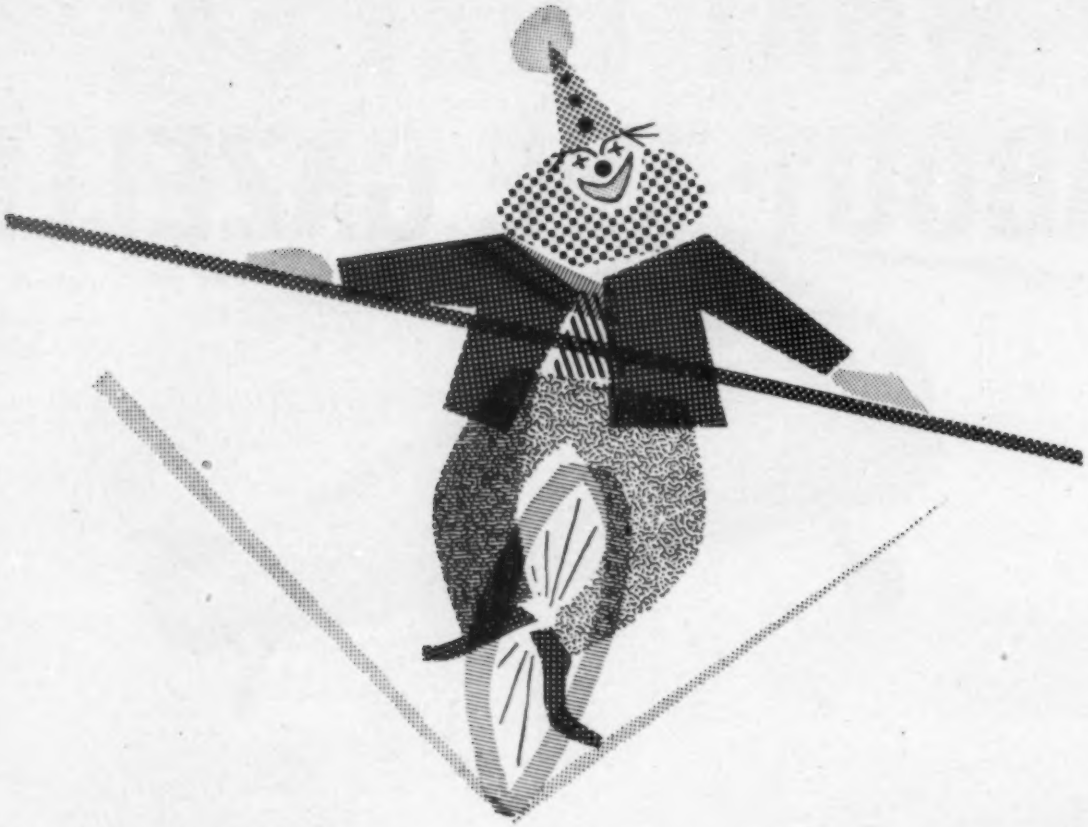

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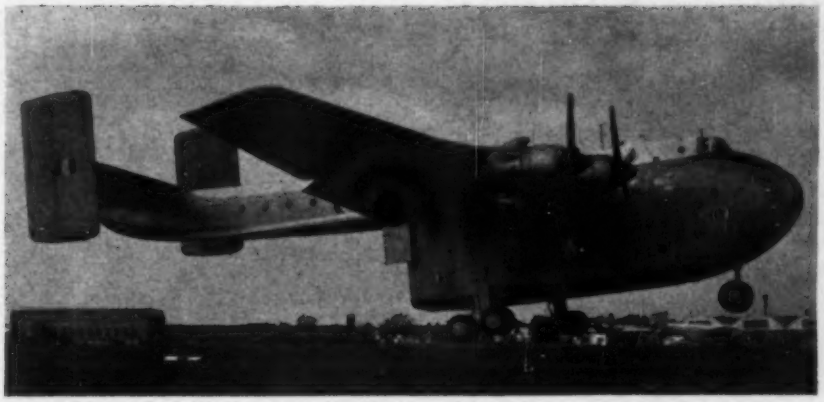
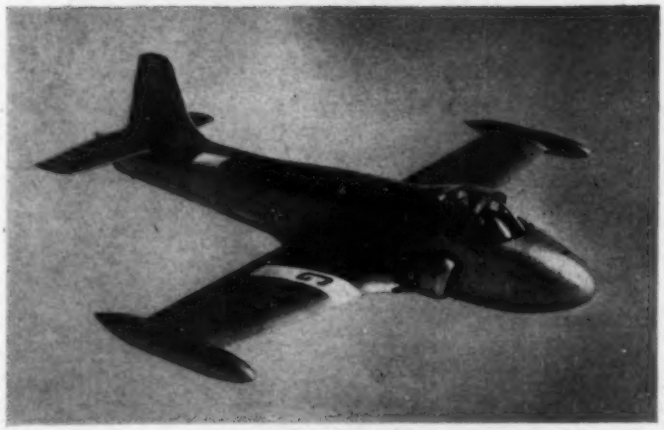
of the World . . .



Above right, Blackburn Beverley C.1 (in heavy-dropping condition).

Below, reading down, Hawker Hunter Two-Seater; Hunting Jet Provost (development aircraft for Jet Provost T.3); and Miles Student.



the standard transport helicopter of the R.A.F., will shortly fly. Alternative missions will be ambulance and search-and-rescue. On a long-range trooping operation of 250 nautical miles, 18 fully armed troops can be carried with a crew of two. On shorter-range operations, as many as 25 troops can be lifted. To aid quick disembarkation in hovering flight, a scrambling net is attached to the lower sill of the door in the forward starboard side of the fuselage. In the ambulance rôle the 192 will carry eight to twelve stretcher cases, arranged in tiers of three along each side of the cabin—in addition to three "sitting wounded."

Bristol Britannia 253 The Series 253 Britannia has been adopted as the standard long-range turboprop trooper/freighter aircraft of the R.A.F. The first example has not yet flown, but the makers claim a maximum load capacity of over 15½ tons and a maximum range of more than 5,000 miles. A body of 115 troops can be flown in comfort on journey stages of over 3,000 miles with meals served from a galley. As a freighter the Britannia 253 has a capacity for four fully laden Army "Champs," complete with trailers.

Fairey Rotodyne Although the Rotodyne has hitherto been publicised principally in the civil rôle, its immense military potentialities will be apparent from studies of detailed articles appearing in *Flight* of August 9 and December 20, 1957.

Short PD.18 The PD.18 is a projected high-wing development of the Bristol Britannia for long-range operations from relatively small fields. It will have a rear-loading facility.

Westland Westminster Fitted, like the Rotodyne, with two Napier Eland engines, the Westminster likewise has extensive military applications. The first example has been completed as a flying crane. Provision could be made, in the eventual cabin version, for 43 fully equipped troops or 32 stretcher cases, with attendants.

TRAINERS

Hawker Hunter Two-Seater (T.7 and T.8) As ordered for the R.A.F. and Royal Navy, the Hunter Two-Seater trainers will be designated, respectively, T.7 and T.8. A lengthy appraisal of the handling characteristics of the second prototype of the Two-Seater was printed in *Flight* of May 17, 1957. This aircraft had the "five-figure thrust" Rolls-Royce Avon but Avons of other series can be incorporated to suit particular requirements. The adoption of side-by-side seating has had a negligible effect on performance. "Tactical" versions of the Two-Seater are in prospect, for all weather fighting and attack.

Span, 33ft 8in; length, 48ft 10in.

de Havilland Vampire Trainer Although now near the end of its extremely successful production run, the Vampire Trainer (D.H. Goblin) remains as a pre-eminent example of the side-by-side jet trainer aircraft.

Folland Gnat Trainer A contract has been placed by the Ministry of Supply for a development batch of 14 Folland Gnat Trainers for the R.A.F. The canopy has been lengthened to accommodate the tandem-seated occupants, and the wing and tail surfaces are of larger area. Ailerons are mounted inboard and split flaps have been fitted in the inner position previously occupied by the ailerons. These changes should confer excellent low-speed handling characteristics. As in all other versions, the Bristol Orpheus turbojet will be standard, and fuel supply will be augmented by tanks in the compartment formerly occupied by the guns and ammunition. Both pilots have a Folland fully automatic lightweight ejection seat.

Hunting Jet Provost T.3 The first full description of this *ab initio* jet trainer—the first to be standardized by any air force and the third consecutive basic trainer designed by Hunting for the R.A.F.—appeared in *Flight* last week (June 13). The turbojet is an Armstrong Siddeley Viper and the occupants sit side by side. The Jet Provost can be modified during production to fit it for weapons training or civil security operations for which a machine gun can be installed in each wing root. Under-wing stores can be 8 × 25 lb bombs or six or twelve rockets, or 8 × 25 lb bombs plus four or five rockets.

Span, 36ft 11in; length, 32ft 5in; gross weight, 7,092 lb; max. level speed, 286 kt at 30,000ft; endurance at 20,000ft, 2.45 hr.

(Continued on page 840, after double page of pictures)

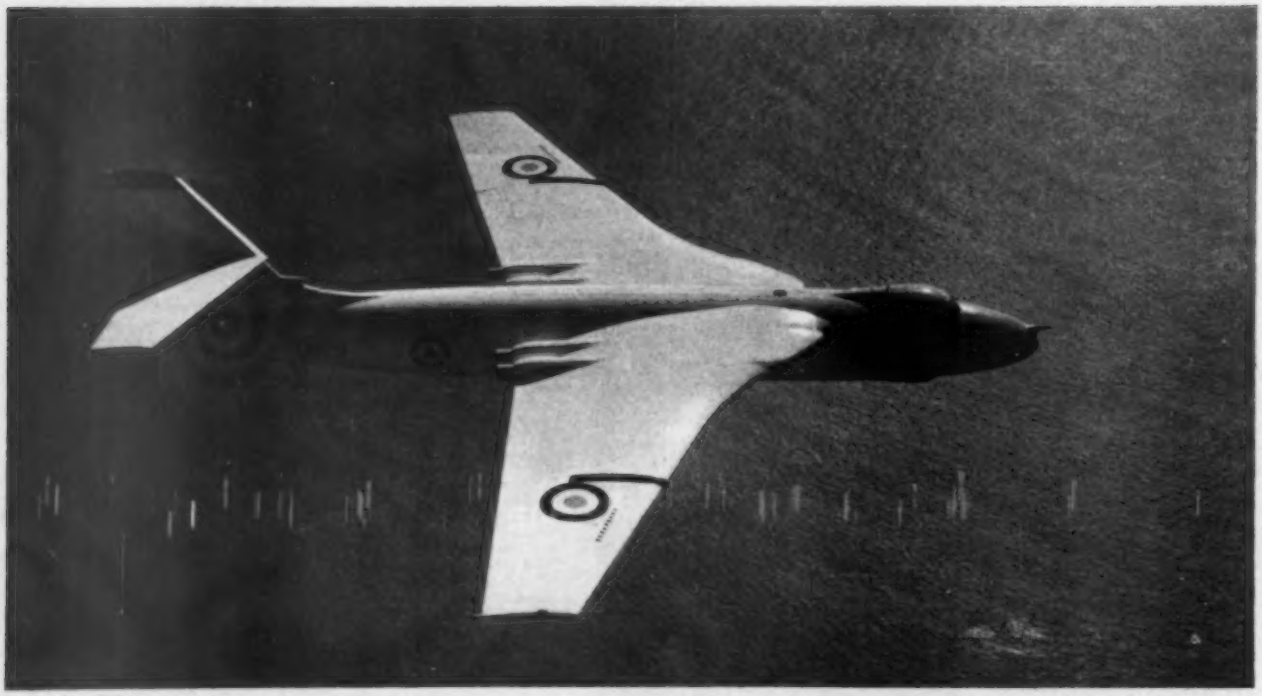
Military Aircraft of the World . .

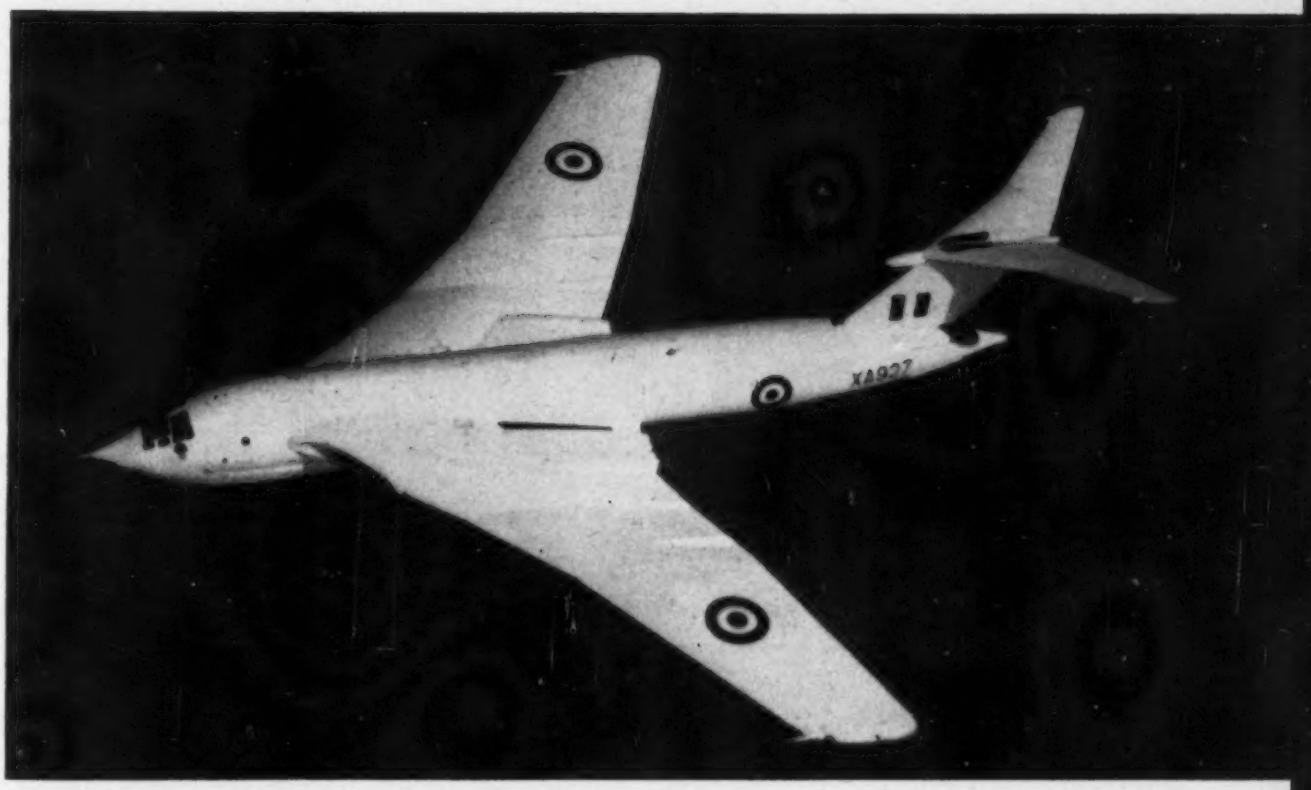
FOR BOMBING AND RECONNAISSANCE

Above, Avro Shackleton MR.3.

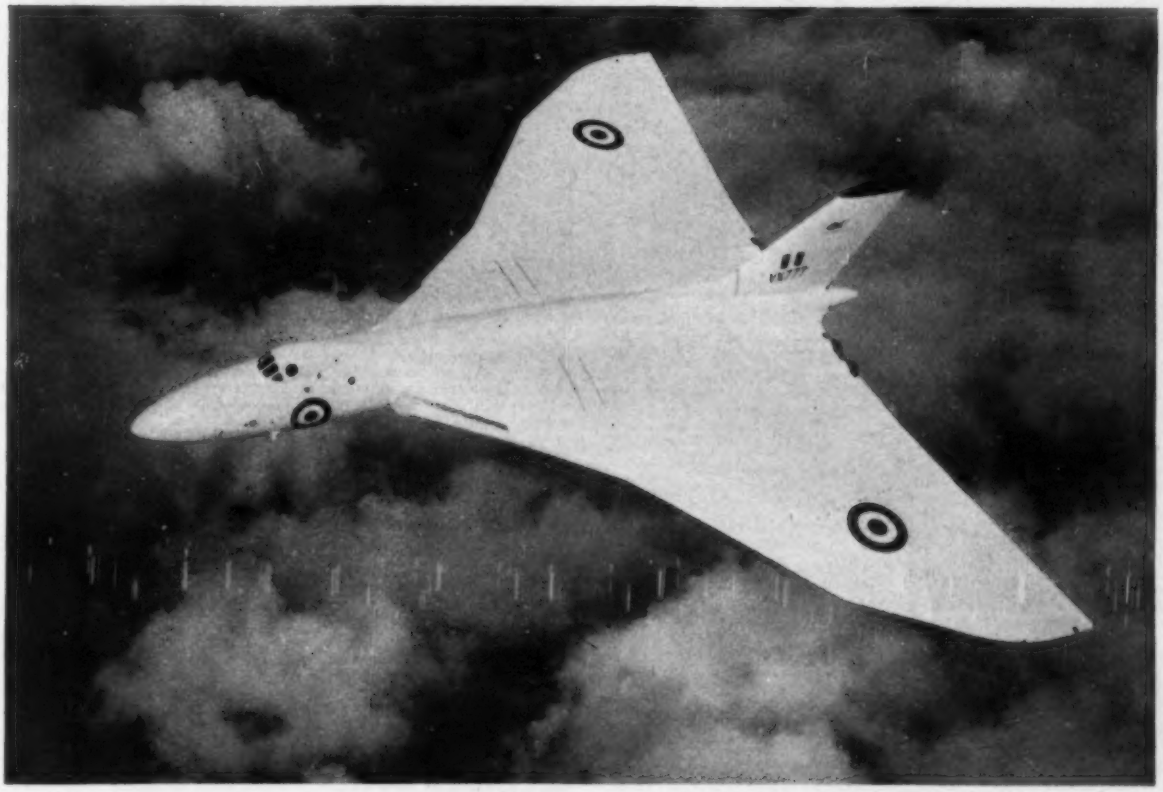
Left, English Electric Canberra B(I).8.

Below, Vickers-Armstrongs Valiant BK.1.





Above, Handley Page Victor B.1 (production aircraft).



Below, aerodynamic vehicle for Avro Vulcan B.2.

Right, Westland Wessex. Centre right, Fairey Ultra-light seen during shipboard experiments. Third right, Westland Whirlwind HAS.7.

Military Aircraft of the World . . .

Miles Student Though designed expressly as a jet trainer, the Student (Blackburn Turboméca Marboré or Continental J69-T-25), is also suitable for offensive missions in a ground support rôle. Access and view are of an exceptionally high order. Possible under-wing armament is two Oerlikon rocket pods (31 × 5 cm each), or six 25 lb R.P.s, or four 60 lb R.P.s, or eight 25 lb bombs.

Data for Student with Blackburn Turboméca Marboré II: Span, 29ft 2in; length, 31ft 6in; gross weight, 3,500 lb; max. speed at 20,000ft, 298 m.p.h.; range with 140 gal (no allowances), 620 miles.

GENERAL PURPOSE, LIAISON AND SPOTTING

Auster AOP.9 Powered with the 180 h.p. Blackburn Bombardier engine, the AOP.9 is the standard aircraft of its class in British military service. It carries a pilot and observer, the latter having a seat which faces fore and aft as required. The pilot's position has detachable armour.

Span, 36ft 5in; length, 23ft 8in; gross weight, 2,125 lb; max. speed, 127 m.p.h.

Bristol Sycamore Powered with an Alvis Leonides engine, the Sycamore continues in production for military service. The basic machine is a five-seater, and is provided with all fixed fittings needed to convert it to any of six major rôles, namely, search and rescue, air ambulance, transport, freight transport, crane and dual instruction.

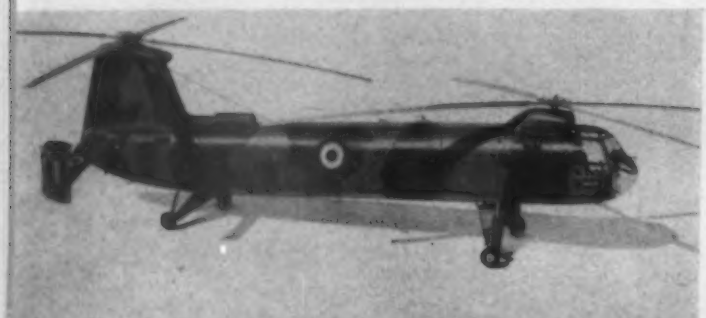
Rotor diam., 48ft 7in; overall length (blades folded), 46ft 2in; gross weight, 5,400 lb; max. speed, 127 m.p.h.

Edgar Percival EP.9 Two military derivatives of the Edgar Percival EP.9 are being evaluated by the British Army. The EP.9 can be equipped to carry two stretcher cases and an attendant, or a walking case in a rearward-facing despatcher's seat. In this rôle space is available for blood-transfusion and portable-oxygen equipment.

Hunting Pembroke Widely adopted at home and abroad, the Pembroke (two Alvis Leonides) is an exceptionally versatile multi-purpose military aircraft suitable for communications, freighting, supply dropping, rescue, photography, navigation and radio or radar crew-training, casualty evacuation and twin-engine training.

Span, 64ft 6in; length, 40ft 6in; gross weight, 13,500 lb; economical cruising speed, 163 m.p.h.

Left, Bristol Sycamore operating in the rescue rôle. Right, Saunders-Roe Skeeter Mk 12. Below, model of Bristol 192 as it will appear in production form for the R.A.F.



Saunders-Roe Skeeter Mk 12 Powered with a de Havilland Gipsy Major 215 helicopter engine, the Skeeter Mk 12 is being supplied to the British and German Governments. Certain of the machines for Germany have provision for Napier rocket boost. The two seats are side by side and full dual controls are available. A long-range tank may be installed in place of the observer's seat, which can be reversed if required for A.O.P. work. There is provision for two stretchers.

Rotor diam., 32ft; length (blades folded), 28ft 5in; gross weight, 2,200 lb; cruising speed, 100 m.p.h.

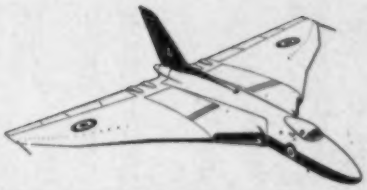
Saunders-Roe 531 Virtually a scaled-up Skeeter, this new helicopter will have a Blackburn Turmo gas turbine and will be a five-seater.

Scottish Aviation Twin Pioneer The Twin Pioneer (two Alvis Leonides) has been adopted by the R.A.F. as a general-purpose aircraft suitable for communication, transport, paratrooping, air freighting, casualty evacuation, supply dropping and bombing. It can have increased tankage for ferrying up to 1,500 miles and operation is possible from improvized strips no more than 300 yd in length.

The single-Leonides Pioneer continues in production.

Span, 76ft 6in; length, 45ft 3in; gross weight, 13,500 lb, typical cruising speed, 134 m.p.h.

FREEDOM OF THE AIR



No. 3 in a series of paintings by Keith Shackleton S.Av.A. presented by Cellon Limited

Pintails in the Snow

The picture shows two drake pintails, one of the most beautiful and fastest-flying of the waterfowl. It is a bird which is common in Britain and breeds here, though its range extends all across Europe, Asia and North America.

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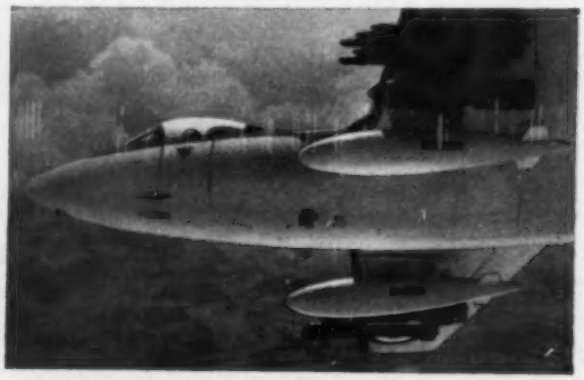
SEA HAWKS ASHORE

The career of the Sea Hawk is something of a paradox. Originally it was adapted from a land-based plane for aircraft carrier work. This rôle it has filled to perfection. But now it is arousing increasing interest among land-based forces. Sea Hawks have already been proved in action, giving ground support to the British Army. And quantities have been ordered by the Navy of the West German Republic, a Navy which has no carriers.

The reason is obvious. For the special qualities required for naval service can be as valuable on land as on sea—particularly in country where big airfields are scarce. The Sea Hawk can be stored and concealed almost anywhere, and it is very easy to fly, handling well at both high and low levels. It has long range and very heavy strike power. It can be used for high speed interception, ground attack, ground support, weapon training, reconnaissance—in fact, is a true all-purpose fighter.

Sea Hawk, armed to the teeth. And what teeth! Rockets, bombs, and 20 mm cannon.



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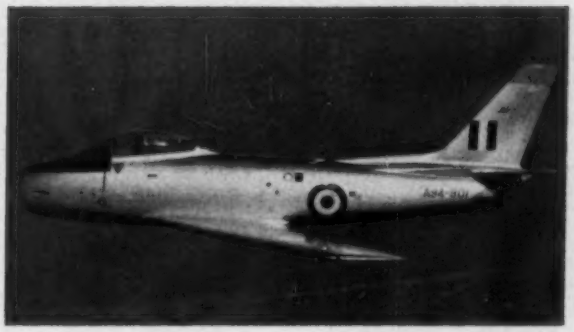
Commonwealth CA-25 Winjeel.



Commonwealth CA-27 Sabre.

Military Aircraft of the World

AUSTRALIA

FIGHTERS AND FIGHTER/BOMBERS

Commonwealth CA-27 Sabre Since 1951 the Commonwealth Aircraft Corporation has been co-operating with North American Aviation in the development and manufacture of an improvement of the F-86F Sabre. The CA-27, as it is designated, has a Rolls-Royce Avon 20 turbojet (made by Commonwealth), rated at some 7,500/8,000 lb. Owing to the increased size of ducting and the rearward shift of the engine mounts, the fuselage has been completely redesigned. Another major change is the adoption of two 30 mm Aden guns as standard armament. The bulk of the first order for 90 aircraft has been completed, and further CA-27s are now coming off the line for the R.A.A.F. In January, Commonwealth ordered more than $900,000-worth of F-86 parts to support this continued output.

Span, 37ft 1in; length, 37ft 6in; gross weight, 17,000 lb; max. speed, about 700 m.p.h.

TRAINERS

Commonwealth CA-25 Winjeel Designed as the standard basic trainer of the R.A.A.F., the Winjeel is a simple but rugged machine reminiscent of the Hunting Provost. The prototype flew eight years ago, and the bulk order, for 62 machines, was fulfilled during 1955-1957. The production CA-25 has a 450 h.p. Pratt and Whitney Wasp Junior, although there is a native engine—the Cicada—suitable for the type. An unusual feature is that there are three seats.

Span, 38ft 7½in; length, 28ft 0½in; gross weight, 4,265 lb; max. speed, 186 m.p.h.; stalling speed (full flap), 53 m.p.h.

Avro CF-105 Arrow.

CANADA

FIGHTERS AND FIGHTER/BOMBERS

Avro CF-100 During 1954-56 Avro Aircraft, of Malton, Toronto, manufactured the Mk 4 version of this big all-weather fighter at a rapid rate. The first Mk 4 flew in October 1953 and differed from its predecessors in having Orenda 9s or 11s, rated at over 7,000 lb thrust each, more advanced radar fire-control (produced by Hughes in Culver City and shipped to Malton) and a new armament comprising 104 folding-fin rockets in wing-tip pods and eight 0.50in guns in a ventral pack. Over 400 4As and 4Bs were delivered.

In October 1955 the first CF-100 Mk 5 was flown. This mark has considerably improved altitude performance, obtained by adding a parallel-chord extension of some 3ft span to the tip of each wing and an extra portion of tailplane and deleting the gun pack. The resulting aeroplane is lighter than the Mk 4, and many Mk 4s are being brought up to this standard. A contract worth $43m has been financed by the governments of Canada and the U.S.A. to supply 53 Mk 5s to Belgium. Total CF-100 deliveries amount to about 650. Now cancelled, there was once a plan to produce a Mk 6, with a new fire control suited to the Sparrow II missile and with afterburning engines.

CF-100 Mk 5: Span, 60ft 10in (over pods); length, 54ft 2in; height, 14ft 6in; gross weight, 33,600 to 36,000 lb; max. speed, about 660 m.p.h.

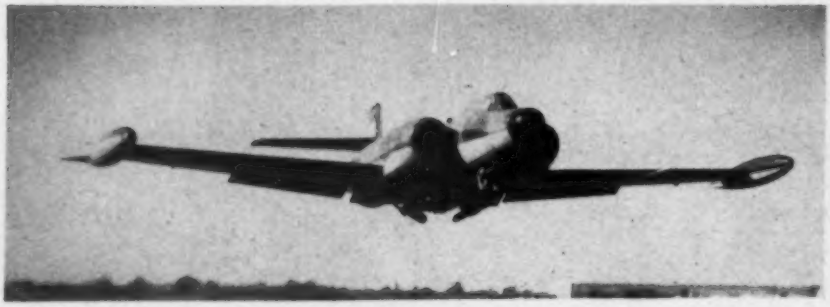
Avro CF-105 Arrow Potentially the fastest aeroplane in the Commonwealth, the CF-105 is a long-range, supersonic all-weather fighter for patrolling the vast reaches of the northern parts of the American continent. It carries a pilot and navigator in tandem, has an armament of Sparrow II radar-homing missiles carried in an internal weapons bay ten feet in width, and is powered by two turbojets with afterburners.

The first CF-105 Mk 1 was completed last October—it was fully described, with a cutaway drawing, in our issue of October 25—and flew on March 25. The batch of Mk 1 development machines are all well on the way to completion at Malton, and each is powered by twin Pratt and Whitney J75s rated at about 23,000 lb apiece with afterburner. Inside the 77ft fuselage is space for a great amount of fuel, supplemented by integral tankage within the thin but extensive delta wing. The engines are fed from variable-geometry lateral intakes and the control system comprises ailerons and elevators carried on the wing and a conventional rudder, all hung from multiple hinges and irreversibly powered (the dog-tooth leading edge is fixed). The main gear has tandem wheels and lies wholly within the wing when retracted.

Production Arrows will be of the revised Mk 2 version, with more powerful Orenda Engines Iroquois turbojets, each giving some 30,000 lb afterburning thrust. The aircraft has been planned as the vehicular portion of a complete weapons system, and all portions of the system, including a range of new support units, are coming into production for the R.C.A.F. Airborne equipment includes the Astra I fire control, embracing search and lock-on radar, fire control (beam-riding included), automatic flight, navigation and communications. Armament includes four or six Sparrows, a range of tactical nuclear special weapons and other loads; there are no inbuilt guns. Materials and parts of the first 37 Mk 2s are already being delivered to Malton and squadron service is scheduled for 1961.

Span, 50ft; length, 77ft 9.7in (83ft with probe); height, 21ft 3in; wing area, about 1,500 sq ft; gross weight, over 65,000 lb; max. speed, about 1,500 m.p.h.

Military Aircraft of the World . .



Right, Avro CF-100 Mk 5.

Below, Canadair CL-41.

Canadair Sabre Since 1951 more than 1,600 Sabres have been built at Montreal by Canadair under licence from North American. From about No. 800 on, all have been powered by the indigenous Orenda turbojet, of from 6,000 to 7,700 lb thrust, and the majority of those in front-line service are of the Mk 5 or Mk 6 versions. Contracts for the R.C.A.F. have been completed and production is now centred upon the Sabre 6 for the West German government, 225 of which are being delivered.

RECONNAISSANCE

Canadair CL-28 Argus Bearing the R.C.A.F. designation CP-107, the Argus is the largest and most completely equipped long-range maritime patrol aeroplane in the world. With an airframe based on that of the Britannia, the Argus differs from the airliner principally in having piston engines—3,700 h.p. Wright R-3350-EA-1 Turbo-Compounds—and an unpressurized fuselage incorporating a weapons bay.

As was noted in our full description, with cutaway drawing, published last October 4, the interior is fitted out for a normal crew of 15, comprising three pilots, three navigators, two engineers and seven signallers. Bunks are provided for those not on duty. Among the extensive electronic devices may be mentioned the AN/APS-59 search radar in a chin radome, and the magnetic anomaly detector (MAD gear) carried in a 15ft tail cone. About 3,650 lb of radar is carried, requiring 41 aerials. The Argus carries ANTAC, an integrated long-range navigation system and tactical display and assessment device.

No guns are carried but there are two weapons bays, each some 18ft 6in long, capable of housing 8,000 lb of assorted stores. Further stores, including special guided weapons, can be slung from underwing racks. All kinds of sonar gear, marine markers and other pyrotechnics can be ejected from pneumatic tubes at the rear of the aircraft. Spoilers are used for extreme manœuvrability at low speeds and the aircraft can accomplish both visual and blind bombing from all altitudes. Typical missions include the following, with full allowances: 72,000 sq mile patrol between 750 and 1,000 n.m. from base (40 n.m. radar sweep assumed); 52,000 sq mile search at radius above 1,000 n.m.; 3.6 hr transit to 1,000 n.m. followed by 3.6 hr combat before return; 3,300 n.m. coastal patrol.

R.C.A.F. Maritime Air Command are to receive at least 25 of these impressive aircraft, and the first unit has already formed. Steady deliveries are now taking place; about 15 have so far been built.

Span, 142ft 3½in; length, 128ft 3in; height, 36ft 8½in; wing area, 2,075 sq ft; basic operating weight, 81,000 lb; fuel and oil, 50,500 lb (54,100 with bomb-bay tank); gross weight, 148,000 lb; max. speed, 250 kt at rated power; four-engine take-off, 3,075ft run, 4,500ft to 50ft; landing over 50ft with half fuel, 2,685ft.

TRANSPORTS

Canadair CL-44 Bearing the R.C.A.F. designation of CC-106, eight of these large strategic transports have been ordered for Air Transport Command. Derived jointly from the Britannia and the CL-28 Argus, the CL-44 will strongly resemble the R.A.F. Britannia 253 in outward appearance, but will be heavier and have much greater payload. Power will be provided by four 5,315 e.h.p. Rolls-Royce Tyne turboprops.

Span, 142ft 3½in; length, 136ft 9in; height, about 37ft; payload, 66,500 lb; gross weight, 205,000 lb; cruising speed, 375 m.p.h.; range with 50,000 lb cargo or 150 passengers and full reserves, 4,200 miles.

Canadair CL-66 Also known as the Canadair 540, this machine is a derivative of the Convair 440, and its production for the R.C.A.F. is being hastened by shipment of the CV-440 tooling from San Diego to Montreal. Ten are at present being built, the powerplants being 3,350 e.h.p. Napier Eland 6 turboprops.

Span, 105ft 4in; length, 80ft; gross weight, 53,200 lb; cruising speed, 326 m.p.h.; max. range, 1,700 miles.

de Havilland D.H.C.2 Beaver and D.H.C.3 Otter Chief customers for these versatile high-wing machines have been the U.S. Army and U.S.A.F. The 450 h.p. Beaver can seat eight; the 600 h.p. Otter can take 12 and weighs 8,000 lb loaded. Features available on either machine include parachuting doors, underwing racks and wheel, ski or float undercarriage.

de Havilland D.H.C.4 Caribou Intensive development of this important STOL transport began late in 1956 when the Canadian army requested D.D.P. sponsorship of a prototype; in the spring of last year the U.S. Army placed a $2.5m order to cover purchase of the third to seventh aircraft inclusive.

Powered by two 1,450 h.p. Pratt and Whitney R-2000-D5 piston engines, the Caribou has a high wing and is specially designed for outstanding short-field and front-line performance. In the rectangular hold (23ft by 87in by 83 in wide) is space for 28 combat troops, 22 stretchers or 7,320 lb of cargo, heavy dropping being possible through an aft door. The first machine is due to fly very soon and delivery is due next February.

Span, 95ft; length, 68ft 10in; height, 36ft to fin tip; empty weight, about 15,000 lb; gross weight, 24,000 lb; short-field take-off, zero wind, 450ft run, 770ft to 50ft; landing, 810ft over 50ft with 300ft run; stalling speed, full flap, 59 m.p.h.; cruise at 52 per cent power, 183 m.p.h. at 7,500ft.

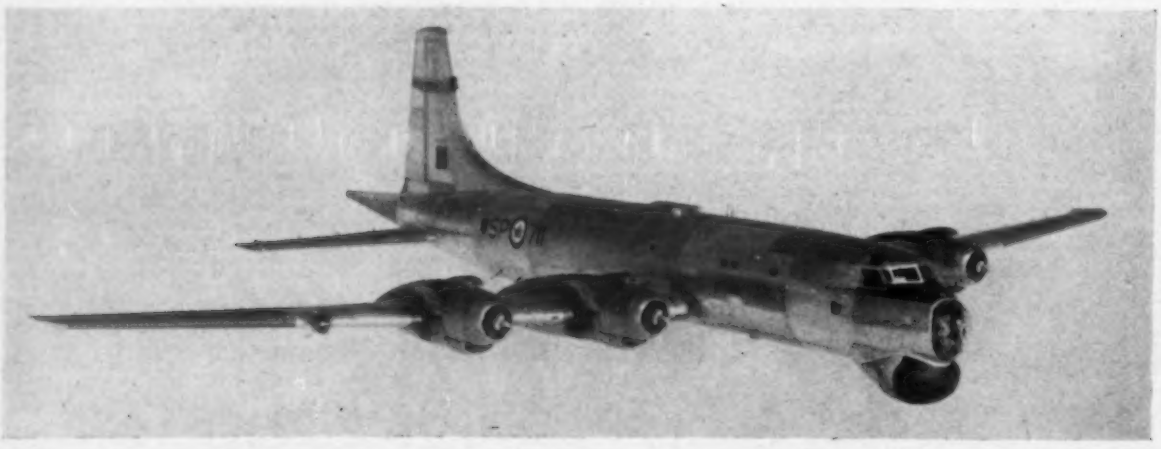
TRAINERS

Canadair CL-41 Two prototypes of this attractive basic trainer are being built as a private venture, both being due for completion at the end of the year. Power is provided by a single Fairchild J83 turbojet of some 2,400 lb thrust, and Canadair claim that the aircraft will "surpass any competitive trainer" in every major aspect of performance and handling. Pilot and pupil sit side-by-side and all fuel is stored in the fuselage.

Span, 36ft 4in; length, 31ft 11in; height, 9ft 0½in; gross weight, 6,500 lb; max. speed, 400 kt; stalling speed, 63 kt; landing and take-off over 50ft, under 1,800ft; range, 800 n.m. on 208 Imp. gal.

Canadair T-33AN Silver Star Production of the Silver Star is now a mere trickle but it was once a flood, and almost 700 have been delivered. The aircraft is basically a Lockheed T-33A, although the powerplant is the Rolls-Royce Nene 10, rated at 5,100 lb thrust.

Canadair CL-28 Argus.



Overnight to Johannesburg

Only a few decades from now, great airliners like this will be flying at heights around 150,000 feet above tropical Africa on the overnight London–Johannesburg run.
On a clear moonless night passengers may see the shimmering reddish-yellow light of the Zodiacal Band stretching like a bridge across the heavens from west to east. According to Fessenkov, the phenomenon is connected with the scattering of light by meteoric matter in interplanetary space; but it also depends on terrestrial atmosphere, the upper layers of which on the night side of the earth are stretched into the characteristic long oval by light pressure.
The petroleum products required for flights at stratospheric altitudes and the extremes of temperature involved are already under active development by Esso Research.

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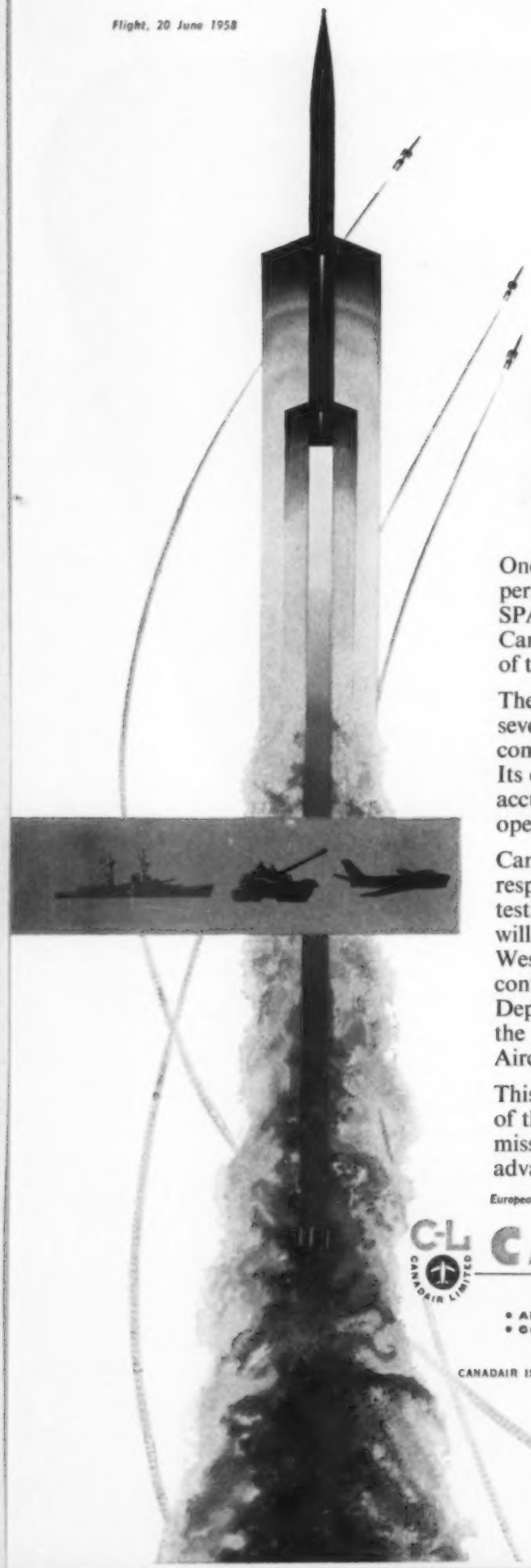

LATEST NEWS

One of the world's most modern high performance air-to-air guided missiles, the SPARROW II, is going into production at Canadair for the Air Defence Command of the Royal Canadian Air Force.

The SPARROW II is rocket powered, flies at several times the speed of sound, and employs a completely self-contained radar seeking system. Its combination of speed, manoeuverability, and accuracy ranks it a match for any present manned operational aircraft.

Canadair as co-ordinating contractor, has overall responsibility for manufacture, assembly and flight testing. In producing the SPARROW II's Canadair will work in close collaboration with Canadian Westinghouse Company Limited as associate contractor, and with the R.C.A.F. and the Department of Defence Production, as well as with the original designer of the missile, Douglas Aircraft Company Inc.

This trust has been placed with Canadair because of the company's extensive experience in guided missile development, and its long record in advanced aircraft systems engineering.

European Representative: J. H. Davis, Princes House, 190 Piccadilly, London, W.1, England

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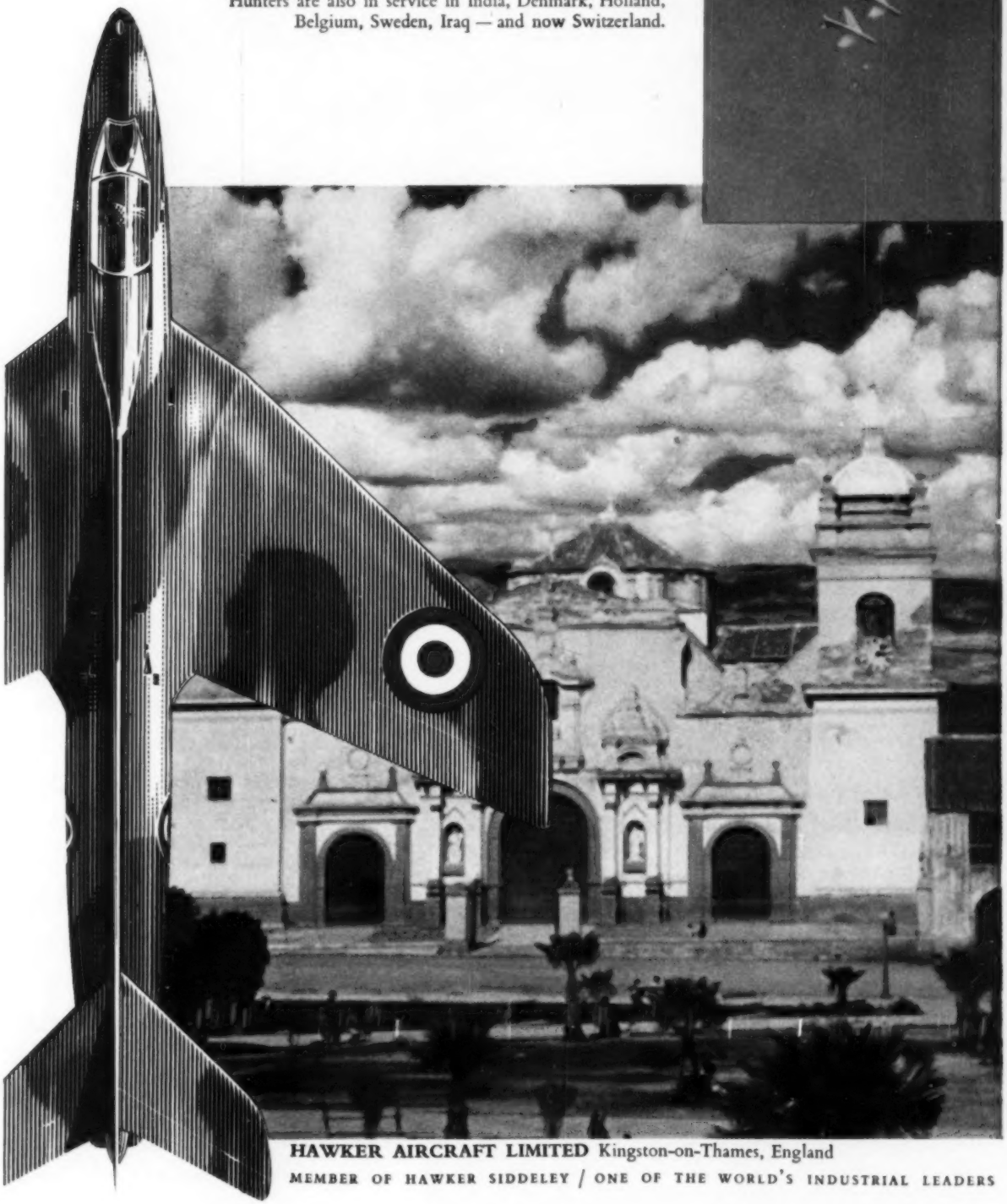
CA58—MI-35-UKT

Hunters Defend PERU

Speed, offensive power and great versatility have given the Hawker Hunter pride of place in the air forces of many countries, including Peru. Today several squadrons of Hunters are in service with the Peruvian air force, forging another sturdy link in the defences of the free world. Hunters are also in service in India, Denmark, Holland, Belgium, Sweden, Iraq — and now Switzerland.



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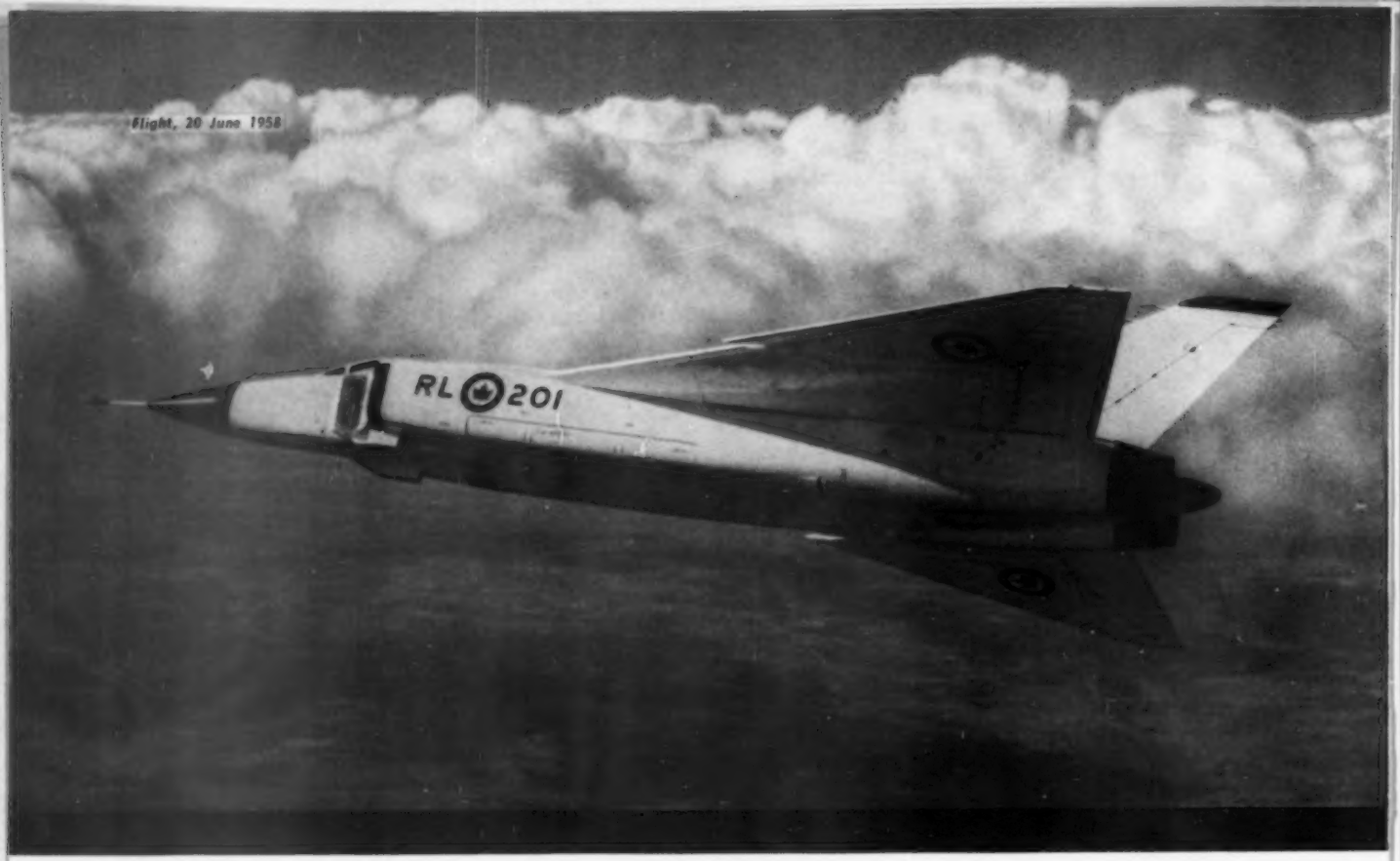

▲ The Avro Arrow is shown in flight during test manoeuvres over Ontario.

The Arrow weapon system is a bomber-destroyer having supersonic mission capabilities. ▼

The Avro Arrow is as big as a World War II bomber yet took off on its first flight in only 3,000 feet of the 11,000 foot runway at Malton. ▼

AN ARROW IN THE SKY

Since its first flight on March 25th, the Avro Arrow has been meeting the vigorous demands of its extensive flight test program. Proceeding according to plan, the Arrow flew faster than sound on its third flight, and more than 1,000 miles per hour on its seventh flight.

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". . . both the U.S.A.F. and the R.A.F. are interested in lobbing IRBMs from manned aircraft . . . and our imagination might go on from there."

Air Power

—IN THE 1960s: A FORECAST

By JOHN W. R. TAYLOR

Drawings by Gordon Horner

TWELVE months ago the future pattern of military aviation seemed clear and simple, at least so far as Britain was concerned. The now-famous White Paper on Defence had implied that there would be no more piloted intercepters after the English Electric P.1 and no piloted supersonic bomber to replace the Vulcan and Victor. Instead, the responsibility for both attack and defence was to be transferred progressively to missiles.

Even allowing for considerable design and operational "stretch," it is unlikely that the P.1 and V-bombers will maintain their full effectiveness beyond the mid-sixties. So the newspapers immediately forecast that the R.A.F. would be a corps of button-pushers from about 1965 onward, to the dismay of those young men who had been looking forward to a flying career in the Service. Simultaneously, the aircraft industry began to panic at the prospect of losing their valuable military contracts; countries like India wondered from where they would be able to meet their future fighter and bomber requirements; and the airlines bemoaned the potential drying up of the traditional source of fully-trained aircrews.

Although the Government seemed determined to persevere with its revolutionary defence policy, to the extent that the highly promising Saunders-Roe SR.177 followed the Avro supersonic bomber into the scrap-bin, there were few persons who considered this realistic. Mr. Krushchev confirmed that the western powers might just as well throw away their bombers, which had been made obsolete by his intercontinental ballistic missiles (ICBMs): but the continued build-up of powerful Soviet strategic bomber forces seems to indicate that he has no intention of following his own advice.

Nor has there been any major change in the forward planning of U.S. air power. On the contrary, North American Aviation alone have received contracts for a new supersonic long-range fighter, the F-108, and a Mach 3 strategic bomber, the B-70, neither of which is likely to be in service before our projected British "all-missile" deadline.

It is, in fact, reasonable to assume that the ideas outlined by the 1957 White Paper were economically and politically expedient rather than strategically advisable. The piloted fighter and bomber will be every bit as essential in the future as they are today, and there was no excuse for the surprise and indignation expressed in certain quarters when senior officers of the Royal Air Force said so in public at the recent Conference Prospect in London.

Complete dependence on any single form of weapon, as proposed in the 1957 White Paper, is practicable only if that weapon is fully developed, completely reliable and impossible to neutralize —in other words, if it is the fabled "ultimate weapon." And the cold hard truth is that the ICBM, at least in its present form, looks far less ultimate than it did a year ago.

Even when all the technical problems of propulsion, guidance and re-entry have been solved, weapons such as the great Convair Atlas will be tied to complex, fixed, ground installations. This not only makes them vulnerable to attack, but points the way to a form of defence against them, based on the fact that they will be launched from a known point and will follow a trajectory that can be pre-calculated.

If the ICBM can be mastered—and America's recent allocation of a further £70 million to the Nike-Zeus anti-missile missile programme implies confidence that it can—air forces might well have to fall back on the piloted bomber as the primary offensive weapon. Piloted bombers in the east would call for piloted intercepters in the west, and *vice versa*. So, whether he likes it or not, the British taxpayer has the choice of either paying for the continued development of both manned and unmanned aircraft, like his U.S. and Russian counterparts, or of taking a very real chance on finding himself without effective means of defence or attack within the next decade.

He can console himself with the thought that the essential objective of western defence planning is to prevent total war, rather than to fight it; for whatever he may be called upon to pay for the deterrent force will be small compared with the cost of an all-out nuclear slogging match. Indeed, it is significant that the Air Ministry considers Britain so vulnerable that Bomber Command might have time to make only one sortie in strength before its home bases were wiped out—and with them much of the rest of the country.

Confronted by such a prospect, it is obviously in everyone's

"The ability of a carrier task-force to steam relatively near to an enemy coastline means that its strike aircraft can be given virtually intercontinental range . . ."

AIR POWER . . .

interest to have a deterrent force so formidable that no nation will ever risk incurring the destruction meted out by even a single sortie. This concept forms the basis of western strategy. Its success depends not only on having the right hardware in the right quantities, but of convincing any potential enemy that it could and would be used with complete effectiveness at the first sign of major aggression.

It becomes clear right away that the apparently simple strategy of the deterrent requires an immense and complex organization, especially when it is carried to the lengths of America's "instant readiness" concept. Yet anything less than instant readiness might not be good enough.

The general functioning of the U.S.A.F.'s deterrent force, based at present on the nuclear bomber fleets of Strategic Air Command (SAC), is fairly well known. In brief, it depends initially, like every military operation, on efficient intelligence. Whether or not this would give any advance warning of an impending attack we do not know, and the first alert might come only when enemy bombers were on their way. But while those bombers remain piloted aeroplanes, there is little prospect of a second Pearl Harbour.

Since May 12 of this year, the U.S. and Canadian air defence systems have been merged formally in the North American Air Defense Command (NORAD), which is now responsible for organizing and operating the defence forces of both countries. Its primary concern is to defend SAC bases, and the most likely direction from which an attack might come is by the great circle route from Russia over the Arctic.

To provide early warning of such an attack, there is first the fabulous DEWline of radar outposts extending from Alaska across northern Canada to Greenland, following the fringe of the Arctic circle. Next comes the Mid-Canada Line, extending across the continent and described as a "double detection fence employing the Doppler principle." Finally there is the Pine-tree Line, which is more or less on the U.S.-Canadian border.

Supplementing the reports of these radar chains are the "Texas Tower" radar outposts built anything up to 200 miles off the U.S. coastline, with radar picket ships still further out to sea. Overhead, blimps and RC-121 Super Constellations, bristling with huge radar antennae, extend the coverage far over the horizon compared with the surface stations, circling and keeping watch for up to 20 hours at a time in the case of the RC-121s, while the endurance of the blimps can be measured in days if necessary.

This vast integrated radar system extends early warning coverage many hundreds of miles beyond the seaboard of the North American continent in every direction. In fact, it links up with the NATO network in Europe to give complete coverage over the North Atlantic. Backing it up are the men and women of the Ground Observer Corps whose job, like that of the British Royal Observer Corps, is to report particularly any low-flying raiders that might slip in under the radar screen. However, the low raider may not soon be such a menace as in the past, because it was stated at Conference Prospect that the R.A.F. will carry out operational tests this year of a new early-warning system that will give complete radar coverage down to sea level.

An important feature of the NORAD set-up is that information received from the radar system is fed into an electronic weapons control system known as Semi-Automatic Ground Environment (SAGE), which directs automatically both fighter squadrons and surface-to-air missile units to ensure that no target is overlooked and no interception duplicated. It works in conjunction with other devices like the Martin Missile-Master, which sorts out those raiders that must be dealt with by Nike missiles and those that call for the specialized attention of the Hawk, which is effective down to ground level.

Having sketched in briefly the techniques of the deterrent and its defence, which are unlikely to change radically in the next decade, we must turn our attention to the weapons with which they will be maintained. At a time of rapid technical progress, it may seem presumptuous to try and look ahead as far as 1970; but a modern intercepter or strategic bomber takes some five or six years to develop from a prototype into a fully-operational warplane and can be expected to remain in first-line service for about the same period; so it is not too difficult to build up a general picture.

At present the strategic deterrent force of the U.S.A.F. consists of eleven heavy-bomber wings, all of which will soon be equipped with B-52 Stratofortresses, 28 medium bombardment wings of B-47 Stratojets, five reconnaissance wings, and support units of KC-97 Stratofreighter and KC-135 tanker-transports.

The B-52s are based primarily in North America at instant readiness, with a token force reportedly airborne at all times, complete with nuclear weapons, as a final precaution against surprise attack. Like virtually all modern U.S. first-line military aircraft, they can be refuelled in flight and so have practically unlimited range. The B-47s are based both in America and at its advanced bases throughout the world, and are a highly trained, extremely mobile force that can be switched quickly, complete with ground crews and equipment in KC-97s, to wherever they may be needed.

This same high degree of mobility is a feature of the R.A.F.'s V-bomber force. It helps to offset the fact that a policy of instant readiness as practised by SAC is economically and operationally impracticable for Britain, because so few squadrons, kept permanently at the ready, would soon become stale. But the A.O.C.-in-C. of Bomber Command, Air Chief Marshal Sir Harry Broadhurst, has emphasized that his force is planned to operate from dispersed bases and could be organized in much the same way as Fighter Command, to react to radar reports almost as quickly as the engines of the bombers could be started.

The only other strategic bomber force is Russia's, consisting primarily of the four-jet Bison, of much the same size as the B-52, the twin-jet Tupolev Badger, comparable with the B-47 and Valiant, and the unique four-turboprop Tupolev Bear.

From the point of view of ability to deliver a nuclear attack on to a specific target, there is little doubt that the R.A.F.'s Victor and Vulcan are the most efficient bombers yet in service, because they cruise so fast and high that they offer the best hope of eluding interception. As they will have to maintain Bomber Command's deterrent capability for many years, perhaps this is just as well.

By comparison, the U.S. and Soviet bombers, particularly the latter, operate at a lower cruising height, which makes them rather more vulnerable. In the case of the B-52, Bear and Bison, this is part of the price in size and performance that must be paid in exchange for intercontinental range, which is not needed by the British bombers because of the relative proximity of their bases to potential targets.

The effectiveness of all these aircraft will be increased when they are equipped with nuclear-warhead stand-off bombs, as they will not then have to approach within range of the close defences of their targets. B-47 squadrons are, in fact, already receiving quantities of Bell GAM-63 Rascal air-to-ground missiles with a reported range of 100 miles at a speed of Mach 1.5.

Normally, one thinks of these weapons as using their rocket power to climb to a cruising height of about 100,000ft and then diving into the target from that altitude. But it has been stated that the R.A.F.'s Avro stand-off bomb will be able to complete its attack at low level if required, and this could well make it even more difficult to intercept. In its developed form, it will also have a range of several hundred miles, which should extend considerably the useful life of the V-bombers.

We know nothing of any second generation of Soviet strategic jet-bombers, although a "Super Bison" is reported to be under development, with at least one airframe scheduled as a test bed for the first aircraft atomic propulsion engine. The U.S.A.F., on the other hand, has released details of its planned re-equipment programme.

The B-47 is scheduled to be replaced by the Convair B-58 Hustler and the Thor or Jupiter intermediate range ballistic missile (IRBM). The B-52 is already being supplemented by the first Northrop Snark "air-breathing" intercontinental missiles and is planned to be replaced eventually by the North American B-70 bomber and the Atlas or Martin Titan ICBM. Clearly, the U.S.A.F. intends to maintain both manned and unmanned deterrent forces for as far into the future as it is practicable to plan, and

this has the added, indisputable advantage of forcing Russia to devote immense resources to maintaining and continually improving its defences against two entirely different forms of attack.

Prototypes of the Hustler have flown at supersonic speed for up to 1½ hours continuously, and one of them attained Mach 2.09 (about 1,380 m.p.h.) at 50,000ft during a demonstration flight for General Power, SAC chief. Production machines will carry a nuclear stand-off bomb in the form of an under-belly pod, and are intended to be escorted by other B-58s carrying podded countermeasures equipment to jam enemy warning and missile-directing radar. All are armed with a Vulcan 20 mm six-barrel cannon, with a 7,000 r.p.m. rate of fire, in a radar-aimed tail-mounting; they may eventually carry defensive missiles.

Anything the B-58 can do, the B-70 will do on a much bigger scale, cruising for long ranges at up to Mach 3 and at heights of more than 70,000ft. Its still-secret design results from half-a-dozen technical break-throughs in metallurgy and aerodynamics, and its engines will burn the new borane-base chemical fuels. Between them, these two aircraft will present a formidable problem to the Russians, especially as they will never need to approach nearer than, say, 300 miles from their target because of their use of stand-off bombs.

What will come after them in the way of piloted bombers is anybody's guess. The most useful hint was given by the R.A.F.'s Assistant Chief of the Air Staff (Operational Requirements), A.V-M. W. H. Kyle, at Conference Prospect, when he remarked that the R.A.F. would need a further generation of manned strategic weapons and added: "That is not to say that we will cling to the idea that we need a bigger and better bomber as we know it now. That would be a reversal of decisions already taken. . . . However, a manned vehicle, that is something retaining discretion, not tied to large and vulnerable airfields but still capable of delivering a weapon from outside the enemy's perimeter defences . . . may be the answer." That was all; but it is known that both the U.S.A.F. and the R.A.F. are interested in lobbing IRBMs from manned aircraft, to overcome the drawback of fixed launching sites, and our imagination might go on from there.

There is no need to describe the SAC missiles in detail. Suffice it to say that Thor and Jupiter have a designed range of 1,500 miles and Atlas and Titan a range of 5,500 miles. The two IRBMs are scheduled to become operational towards the end of this year, in both the continental United States and Europe. Atlas is expected to be ready for issue to SAC units next year, followed by the Titan which, although it has not yet reached the firing stage, is reported to be even more promising.

All of these missiles represent tremendous achievements and will strengthen very considerably America's deterrent power. Their inertial guidance systems, being self-contained, are virtually unjammable; and all can be air-transported. Their disadvantages are that they burn liquid fuels which offer handling and logistic problems, and that they need such extensive ground equipment

"There is a revival of interest in the simple, light, low-powered and comparatively low-performance 'colonial' aircraft . . ."

that they lack the flexibility of manned bombers. They will be supplemented in due course by the de Havilland IRBM which, with a 2,000-2,500 mile range and the ability to be launched from underground, promises to be an extremely valuable missile. Initially, there will be no defence against them, apart from attacks on their launching sites; but, as already mentioned, the ability of radar and electronic computing apparatus to detect their launchings and work out the probable point of re-entry of their warheads may make it possible one day to intercept the warhead and destroy it harmlessly at a great height.

Mobility is seen, therefore, as a very worthwhile asset to any deterrent force, because it keeps the enemy guessing as to the direction from which an attack might come and makes it more difficult for him to neutralize. That is why Naval forces still have a key rôle to play in any deterrent strategy.

It was fashionable a few years ago to decry the aircraft carrier as a left-over from the pre-atomic age. In fact, it might well be less vulnerable than fixed shore bases for bombers or missiles in the first few vital hours or days of a major war, through its extreme mobility over 70 per cent of the earth's surface.

The ability of a carrier task-force to steam relatively near to an enemy coastline means that its strike aircraft can be given virtually intercontinental range without being large and cumbersome. The most advanced aircraft of this type yet revealed are the British Blackburn NA.39 and the U.S. North American A3J Vigilante—two entirely different designs which are intended to do much the same job of delivering a nuclear weapon at around sonic speed.

In order to be capable of Mach 2.2 at high altitudes, the A3J has ended up as a 49,500 lb two-seater powered by two afterburning J79 turbojets and able to operate only from the *Forrestal* class of super-carriers. By comparison, the NA.39 is intended for low-

"But the real key to battlefield mobility and flexibility lies in VTOL and STOL techniques . . ."

level missions and is a small two-seater with two Gyron Junior turbojets and the ability to fly from any normal fleet carrier. These differences may be a psychological result of the American Navy's refusal to grant performance superiority to the U.S.A.F. and our own need to cut our coat to suit some limited budgetary cloth, although low-level attack offers important tactical advantages.

The important fact is that both machines will add immeasurably to the West's deterrent power for as long as carriers can continue to defend themselves efficiently from counter-attack by aircraft, missiles and submarines. In any case, they do not represent the full extent of the Navies' strategic attack, for already part of the force has sought the greater safety of underwater operation.

Two very remarkable submarines have been built for the U.S. Navy. The first, U.S.S. *Grayback*, was put into commission on March 7 this year; the other, U.S.S. *Growler*, was launched on April 5. Each is equipped with two streamlined deck hangars for either Regulus I or Regulus II surface-to-surface missiles. In action, they would approach the enemy coastline unseen and surface quickly, the hangar doors would swing open and the missiles would be rammed automatically into launching attitude on swivelling ramps. Within five minutes of surfacing, the missiles could be on their way, enabling the submarines to crash dive.

Here, indeed, is a weapon of frightening potentiality, because the jet-powered Regulus II is a supersonic missile with a range of well over 1,000 miles and the ability to fly to its target above 60,000ft or low under the normal radar screen. Despite its self-contained inertial guidance, it can be pre-set to fly a dog-leg course to confuse the defences.

What is more, it is only a start, because *Grayback* and *Growler* will be joined soon by the nuclear submarine *Halibut*, whose keel was laid last July, and three more Regulus-armed nuclear subs have already been authorized under the 1958 shipbuilding programme.

Beyond them are 5,600-ton nuclear-powered submarines each specially designed to carry 16 of the new Lockheed Polaris fleet ballistic missiles, and these must certainly be regarded as the nearest approach yet to an ultimate weapon. As a start, their mobility will give the Polaris the equivalent range of an ICBM, although it is a comparatively small missile with all the advantages resulting from use of solid propellants. As it can be launched while the submarine remains under water, the chances of detecting its launching are remote and the difficulties of arranging a reception committee of anti-missile missiles are correspondingly increased. In fact, the combination of nuclear submarine and Polaris, more than anything else, should avert any possibility of a third world war being provoked deliberately.

As was pointed out earlier, however, much of the effectiveness of the overall deterrent force depends on the extent to which it can be protected from attack at its bases; so a great deal of effort must still be put into defensive weapons. And this is where the arguments between the advocates of piloted aircraft and the missile enthusiasts become really heated.

Everyone agrees that the two are complementary for the next seven years or so, the basic requirement being for a single-seat day fighter and a two-seat all-weather and night fighter to intercept enemy bombers as far as possible from the target area, plus a high-altitude missile with a slant range of up to 70 miles and another missile capable of dealing with low-flying raiders. This requirement is doubled by the necessity of providing equivalent defences for Naval forces at sea.

Typical—perhaps best—of the next-generation single-seat fighters is the P.1, with its speed potential of about Mach 2.25 when used in mixed-power form and considerable range when fitted with an external fuel tank in place of the rocket-pod. Although its primary armament is given at present as two de Havilland Firestreak infra-red homing missiles, with two 30 mm Aden guns as secondary weapons, it would seem logical for a

". . . it will be increasingly necessary to airlift heavy equipment."

". . . a two-seat all-weather and night fighter to intercept enemy bombers as far as possible from the target area . . ."

fighter with all-weather capabilities to sprout also a pack of unguided folding-fin rockets in due course. Such a combination overcomes the occasional inability of infra-red missiles to "see" their way to the target through thick cloud.

Britain's "final" two-seat all-weather fighter is scheduled to be the Gloster Javelin, subsonic, but popular and efficient and soon to have reheat added to its two Sapphires to extend its useful life. Its armament consists of various combinations of Firestreaks, unguided rockets and 30 mm guns, giving it the ability to cope with any current potential enemy raider. However, its period of usefulness must be limited, and what comes next?

It seems possible that the R.A.F. may decide eventually to order the Avro (Canada) Arrow, largest and most sophisticated fighter ever flown, with a performance potential of Mach 2.3 without rocket boost and a very heavy missile armament. Although it has been designed to fit into the NORAD system, under which interceptors can be flown to their target by ground control and their missiles fired automatically, it could probably be adapted to the British system which continues to leave much of the responsibility in the hands of the pilot.

The huge delta form of the Arrow is one of the shapes of tomorrow, and many designers believe that the future may lie in hypersonic deltas with a leading-edge sweep of anything up to 80 deg. Nor are we likely to have seen the last of the tail-first straight-wing configuration of the abandoned Avro supersonic bomber. In this respect, it will be interesting to see what shape North American choose for their B-70 bomber and F-108 fighter, both of which are in the Mach 3 class. The result may well be as surprising as the very orthodox layout of the same company's X-15 research aircraft, designed for Mach 5-7 at heights up to at least 100 miles.

The one thing that is certain is that there will be a continuing need for piloted fighters of ever-increasing performance, whatever their shape. It is easy to see why if we study the limitations of surface-to-air missiles.

Best of the currently available crop are probably the American second-generation Nike-Hercules and Talos and the British Bloodhound and Thunderbird. None of them uses objectionable fuels, Talos and Bloodhound burning turbine fuel in their ramjets and the other two being solid-propellant rockets. Their probable range of around 50 miles is adequate and they offer a valuable last-ditch defence ring against raiders that slip through.

They do not in any way replace piloted intercepters, because the prime essential of a nuclear-age defence is to deal with the enemy raider as far away from the target as possible—a requirement that will become increasingly important as free fall bombs give way to the stand-off type.

The only missile yet announced with enough range to do the fighter's job is the ramjet-powered Boeing Bomarc, with a designed radius of action of 250-300 miles in its initial form and up to 500 miles in its later version. This is a true pilotless intercepter, with even an aeroplane configuration, and its efficiency was proved when a test round sought out, rammed and destroyed a target plane 100 miles from its launching site, although the missile was not fitted with a warhead.

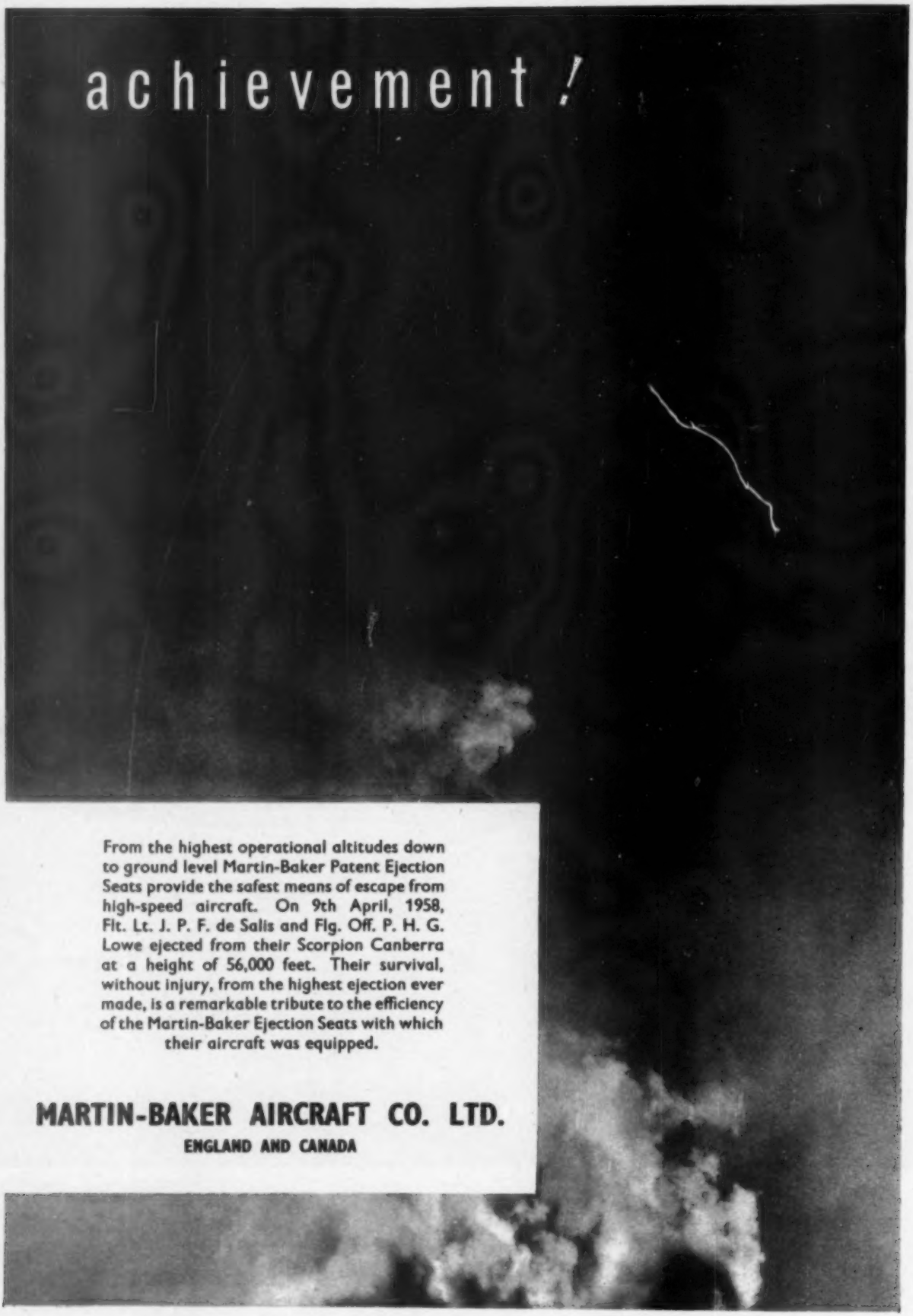
However, there are limits to what Bomarc (or any other missile) could do. If, for example, a foreign reconnaissance aircraft came over for a bit of quiet snooping in peacetime, a piloted fighter could be sent up to ward it off, in the same way that the Royal Navy keeps unauthorized ships out of our territorial waters. A missile could not do so; nor could it deal with any enemy aircraft that might cruise up and down some distance from our shores in wartime, using countermeasures equipment to jam all our radars. Even worse—if the enemy mounted an attack at the same time that our own bombers were returning from a sortie, it is unlikely that missiles could sort out friend from foe and we should be left defenceless without the discriminating brain of a human pilot.

So much for the deterrent and its defence—all-important in one respect and yet completely negative, because if they ever go

de Havilland Sea Vixen (2 Rolls-Royce Avon engines)

All-weather radar-equipped fighter for the Royal Navy, carrying de Havilland Firestreak guided weapons.

A most adaptable aircraft.



From the highest operational altitudes down to ground level Martin-Baker Patent Ejection Seats provide the safest means of escape from high-speed aircraft. On 9th April, 1958, Flt. Lt. J. P. F. de Salis and Flg. Off. P. H. G. Lowe ejected from their Scorpion Canberra at a height of 56,000 feet. Their survival, without injury, from the highest ejection ever made, is a remarkable tribute to the efficiency of the Martin-Baker Ejection Seats with which their aircraft was equipped.

MARTIN-BAKER AIRCRAFT CO. LTD.

ENGLAND AND CANADA

AIR POWER . . .

into action they will have failed in their primary rôle of preserving the peace.

There is every reason to hope that they will not fail, because the consequences of an all-out nuclear war would be little less terrible for the victor than for the vanquished.

Post-war experience has shown that an all-out war is not always necessary to gain a limited objective, and that a gradual process of nibbling off small parcels of territory over a period of years might well achieve the same final results without any great loss of life.

The past record of the Communist countries in this respect cannot be overlooked because, although they have never launched a world struggle, their forces have fought in 14 local wars during the past 40 years. In no fewer than 12 of these their aim was to extend their political and territorial power.

If we think only in terms of the years since World War II, Russia or its allies have taken part in eight of the 15 small wars which have occurred, despite the fact that the western powers possessed an atomic superiority which amounted at first to a monopoly.

Up to now, therefore, the nuclear deterrent has played little or no part in preventing limited wars; but the position has recently changed.

So far as Britain is concerned the expenditure on our nuclear striking force is only 10 per cent of the total defence estimates; but if we were not able to count on the deterrent and destructive power of atomic and hydrogen bombs we should need a force of at least 1,000 bombers, 1,000 fighters and tactical air power on the scale of the last war, which would be crippling in an age when a V-bomber costs £1 million and a P.1 perhaps £400,000. Even then, the West could never hope to match Russia with conventional (non-nuclear) arms only.

To make up the disparity, it was made clear in the 1958 White Paper on Defence that any major attack, even with conventional weapons, against any nation with whom we have an alliance will in future be met by nuclear counter-attack. This is a somewhat alarming policy, because no hint is given as to what would constitute a major attack, and once tactical atomic weapons were brought into use the possibility of expansion into a full-scale nuclear war would become very real indeed. We can only hope that this very vagueness will act as a deterrent against minor aggressions.

It is too much to expect that it will, and that is why so much of our effort must continue to be directed at fighting limited wars, "police actions" or local campaigns like those waged post-war in Korea, Malaya, Kenya, Suez, Oman and elsewhere. Bomber Command proved at Suez that its Valiants can play an important rôle in such battles; but the increasing complexities of first-line bombers and fighters make them less and less suitable for anything but their primary task, and local wars will in the future demand their own specialized types.

The first essential in any such campaign is to get the ground forces and their equipment quickly to the scene of action. If this could have been done speedily enough in Korea and at Suez, the results might have been very different.

Requirement No. 1, therefore, is for very extensive and efficient air transport capability—certainly far more than is represented by R.A.F. Transport Command's 30 Hastings, 10 Comets and 24 Beverleys, even when supplemented by 20 Britannias and some squadrons of Twin Pioneers.

To plan an ideal air transport force is comparatively easy. For the high-speed transport of troops and supplies, the Boeing KC-135 meets requirements admirably, especially as it can double as a SAC tanker-transport. Britain could, and probably will, save dollars by ordering a military version of the Vickers VC.10 and/or D.H.121; while Russia has ready-made military transports in the Tu-114 and Tu-110, which share so many components of her standard bombers.

It is no longer good enough to count on stock-piling overseas, because few bases are permanent or secure; so it will be increasingly essential to be able to airlift heavy equipment. The U.S.A.F.'s Douglas C-133, with its 45-ton payload, backed up by the Lockheed C-130 Hercules, with a 17-ton payload, or the projected Blackburn B.107 four-turboprop development of the Beverley, could accommodate virtually any type of missile or army vehicle except a heavy tank.

Once the armies, and their supplies and equipment, have reached the theatre of operations, the job of non-VTO transport aircraft should be over. In fact, it is not beyond the bounds of possibility that by 1970 no non-VTO aircraft will ever need to operate in a forward battle area in a limited war. The only task for which they are really essential at present is ground attack, and here there is already a noticeable trend away from the powerful intercepter-type fighter.

For major (but not quite total) wars there is still need for a high-speed strike aircraft with nuclear capabilities. The U.S.A.F. will have the F-105 Thunderchief; the R.A.F. has issued a specification for a Canberra replacement, but may take a shore-based version of the NA.39 to avoid the development costs of a new type. For a less complex war, as a Venom replacement, it may have the little Folland Gnat; but there is a revival of interest now in the type of simple, light, low-powered and comparatively low-performance "colonial" aircraft represented by the new French Epervier, Sipa 1100 and Voltigeur series.

But the real key to battlefield mobility and flexibility lies in VTOL and STOL techniques, because there are many places and circumstances in which it would be difficult to find runways for even a Gnat or an Epervier. It must surely be only a matter of time before all major forward supply and transport operations are handled by aircraft like the 48-seat Fairey Rotodyne helicopter or developments of the Hiller X-18 tilt-wing aircraft. A start has already been made with smaller helicopters like the Whirlwind; eventually helicopters and aircraft with tilting wings, ducted fans and other VTO devices should take over the remaining duties, including liaison, observation, flying crane operations and even close support work with lightweight rockets and missiles. There is a precedent for this at sea, for the Royal Navy has announced that the Gannet will be its last fixed-wing anti-submarine aircraft, giving way eventually to helicopters for this important and decidedly offensive duty.

". . . last fixed-wing anti-submarine aircraft, giving way eventually to helicopters for this important and decidedly offensive duty."

The chief danger to all types of aircraft during future operations in combat areas will be from missiles launched by ground forces, and this will be particularly true in the case of relatively slow helicopters. For that reason, reconnaissance to detect enemy missile-launching positions will be of paramount importance. The U.S. Services are experimenting with the use of small pilotless drones, carrying cine-cameras or TV equipment for this work, to avoid endangering aircrew lives; but the big snag with this idea is that the drones will photograph only the areas over which they are sent and will fail to spot the all-important tell-tale indications of the unexpected that a human pilot so often notes.

Before the start of World War II, the German General Baron von Fritsch said that it would be won by the side with the best photo-reconnaissance, and he was right. The importance of this duty has not lessened and never will. The soldier in the front line is immobilized without it; the deterrent forces of piloted bombers and missiles can be effective only when their targets are known precisely. That is why a proportion of the finest available fighter and bomber aircraft have always been set aside and modified for reconnaissance.

This practice will continue; but the next decade may well see more startling developments in reconnaissance techniques than in any other aspect of military aviation. Bell Aircraft, for example, have a contract to study the possibilities of a piloted hypersonic glider that would be launched to a great height with the aid of a missile-type booster rocket and would then do its photo-run in a 3,000 m.p.h. glide before returning to base.

Lockheed's projects are even more advanced, because they plan to take reconnaissance cameras out beyond the atmosphere into space. First will come WS-117L, sometimes referred to as Pied Piper, an unmanned orbital satellite so launched that its path will pass over the territory of any potential or real enemy, photographing everything below through TV eyes.

Far more interesting is the news just received that this same company is working on a very large Earth satellite with a recoverable capsule. This might, of course, be a version of WS-117L; on the other hand, it might be manned. If it is, air power will enter a new and immensely interesting phase—and this could happen in the 'sixties.

Military Aircraft of the World . . .

FIGHTER LOADS

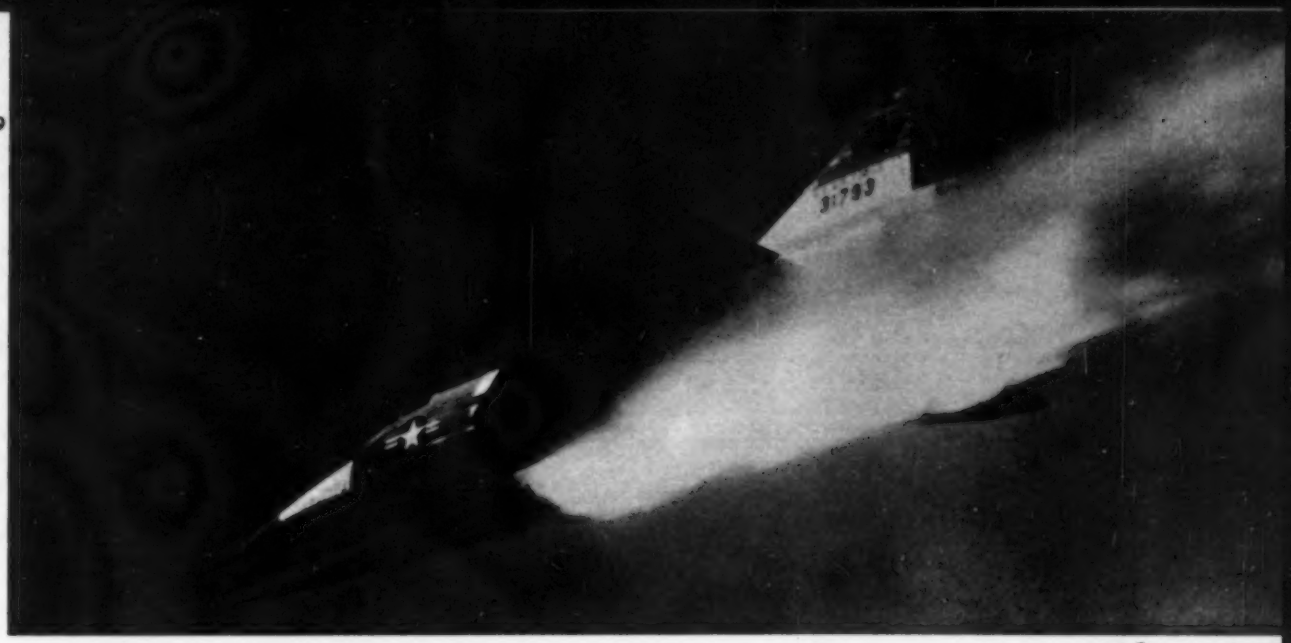
Installations of Air-to-Air Guided Missiles and Unguided

1 English Electric P.1B with two D.H. Propellers Firestreak air-to-air guided missiles.

2 SO. Trident II (now abandoned) with MATRA experimental air-to-air guided missile.

3 Installation of D.H. Propellers Firestreak and a 37-tube Microcell rocket pack on a Gloster Javelin FAW.7.

4 A Hughes GAR-1D Falcon air-to-air guided missile (foreground) displayed, with a Mighty Mouse 2.75in unguided rocket projectile, by the pilot of a Convair F-102A (background).



5

Rocket Projectiles on British, American and French Aircraft

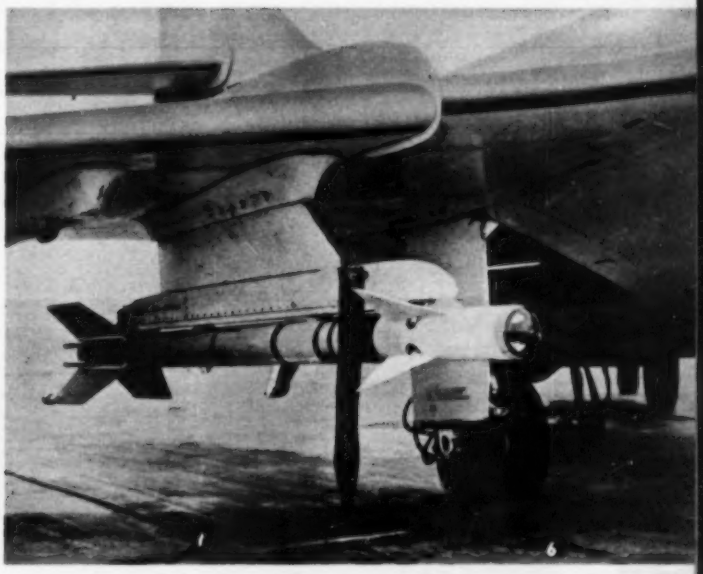
5 A salvo of twenty-four 2.75in rockets at the instant of being fired from a Convair F-102A.

6 Philco Sidewinder air-to-air missile on Grumman F9F-8 Cougar.

7 Four 30 mm guns with ammunition and air-to-air rocket projectiles as carried by SO.4050 Vautour.

8 Retractable Microcell 2in air-to-air rocket packages (total of 28 projectiles) on de Havilland Sea Vixen FAW.1.

9 Two Firestreaks and tank on Sea Vixen FAW.1.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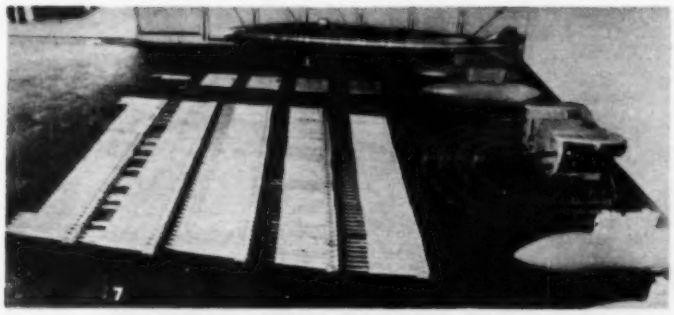
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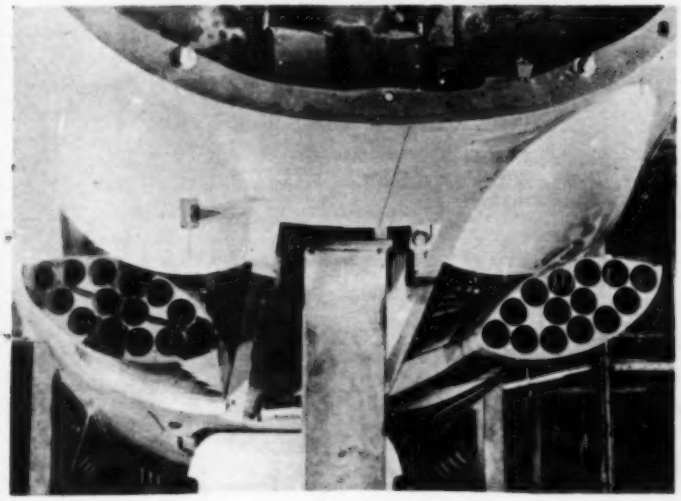
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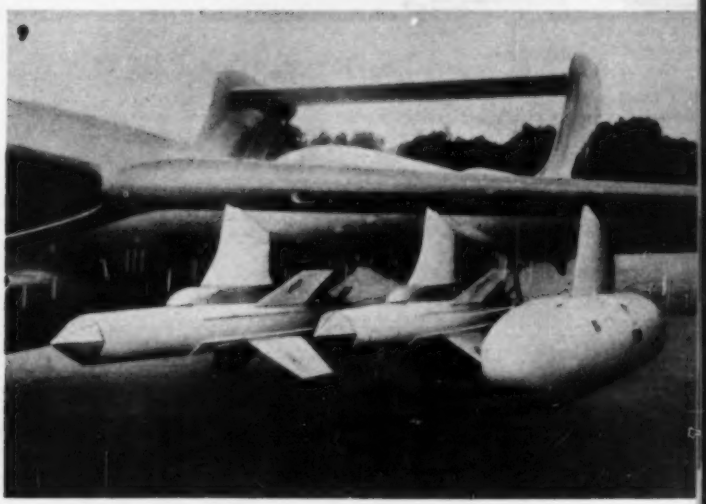
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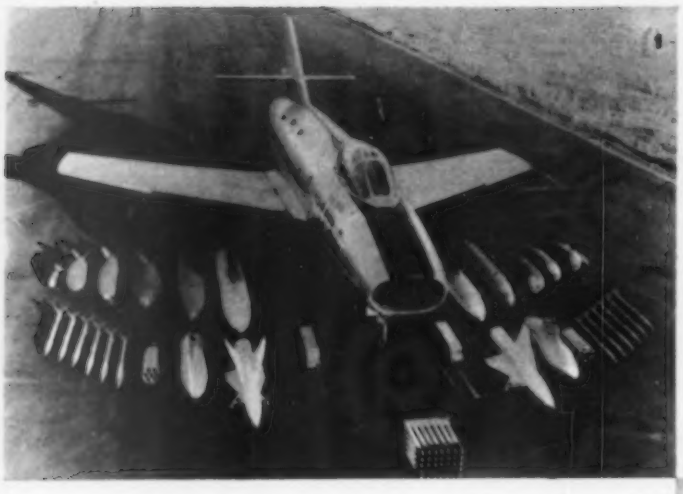
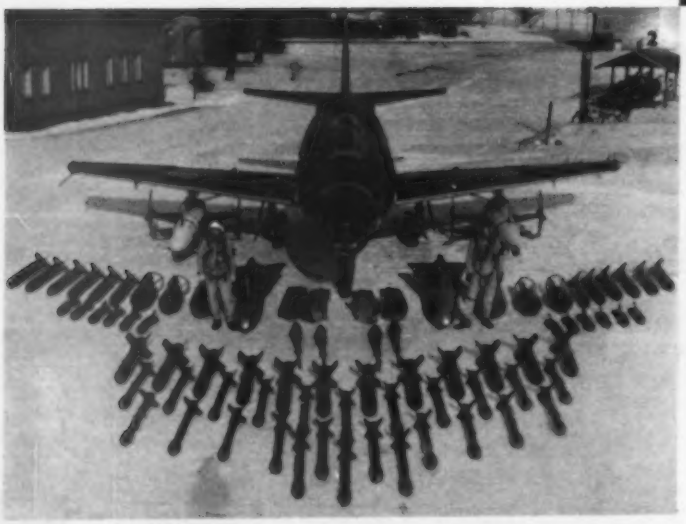


Military Aircraft of the World . . .

ATTACK LOADS

Representative Combinations of Rockets, Bombs, Missiles and Tanks



1 Dassault Super Mystère with two 30 mm guns, 35 rockets in retractable ventral pack and various possible combinations of honeycomb rocket-containers, 500 kg bombs, napalm tanks, hollow-charge rockets, Nord 5103 missiles and auxiliary tanks. (The pack of 35 rockets can be replaced by a tank.)

2 Saab 32A Lansen with (front) 24×15 cm rockets and 12×18 cm rockets; middle row, six 50 kg bombs, the four 20 mm guns and six more 50 kg bombs; back row, six 100 kg flash bombs, two 250 kg bombs, a 500 kg bomb, a drop-tank (or napalm); the four 20 mm ammunition boxes, and the previous stores in reverse order. The Lansen is carrying two Type 304 missiles.

3 Fiat G.91 showing fixed armament of four 0.5in guns in hinged panels and external alternative loads of 5in rockets; honeycomb packs of 30 folding-fin rockets; 3in rockets; and two 500 kg bombs. Nord 5103 command-guided missiles may also be fitted.

4 North American F-100 Super Sabre releasing 144 rockets from six Aero 7D launchers.

5 Douglas A4D-2 Skyhawk with (centre) twin-barrel 20 mm gun pod, and auxiliary tanks.

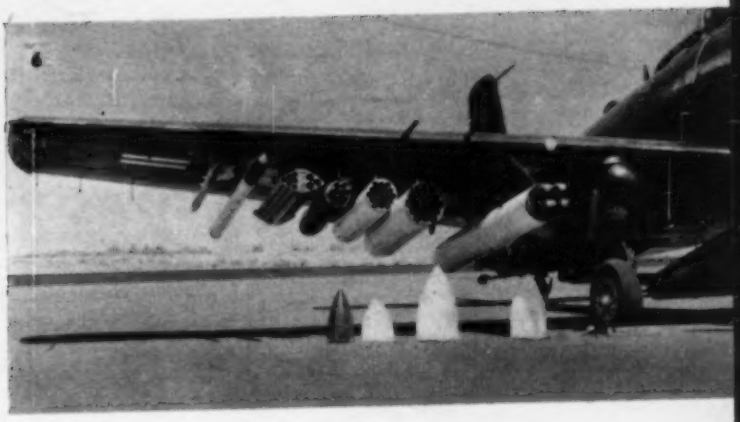
6 Douglas AD-6 Skyraider, with (l. to r.) one 2.75in rocket, one Zuni rocket, combination of 2in and 2.75in rockets in launcher, seven-unit launcher (2.75in), 19-unit launcher (2in), 19-unit launcher (2.75in), and four-unit launcher for Zuni.

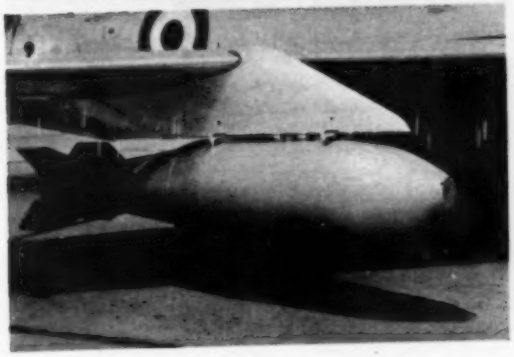
7 Nord SS-10 anti-tank missile on Bell 47.

8 Arming a North American FJ-4B Fury with six Martin Bullpup air-to-ground missiles.

9 Fiat G.91, showing installation of 500 kg bomb.

10 McDonnell F3H-2N Demon with two 500 lb low-drag bombs, four 250 lb G.P. bombs, and two 1,000 lb low-drag bombs.





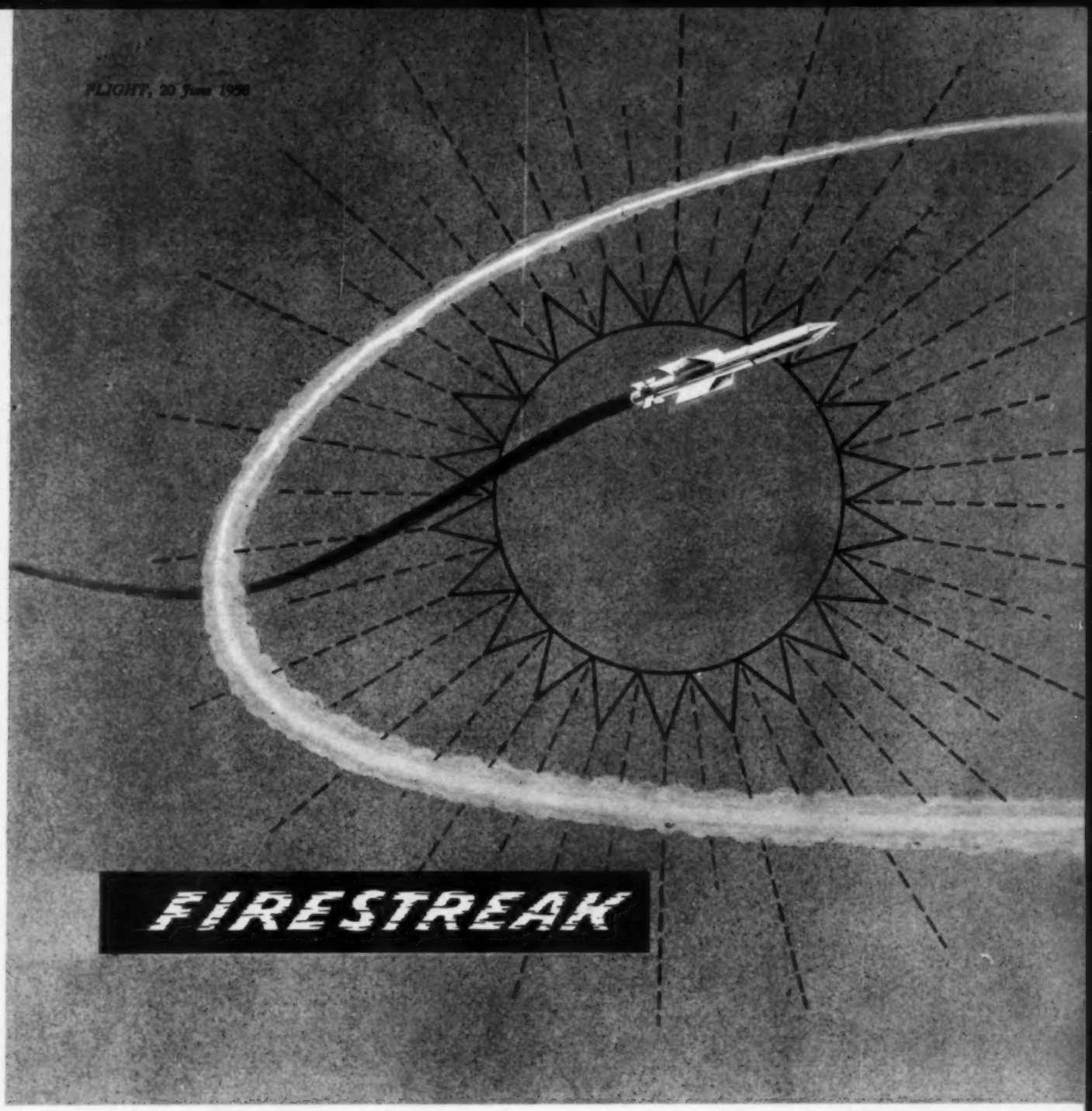
Military Aircraft of the World . . .

BOMBER LOADS

Guided "Stand-off" Bombs, Free-falling Bombs and Defensive Gun Installations

1 Avro Vulcan B.1 with experimental Avro stand-off bomb.
2 Boeing B-47 releasing salvo of free-falling bombs.
3 Convair B-58 with "pod" for carrying military loads.
4 Bell GAM-63 Rascal guided bomb on Boeing DB-47.
5 T-171 multi-barrel gun (20 mm) in Convair B-58.

6 Tail gun position (4×0.5in) of Boeing B-52.
7 Tail gun position (2×20 mm) of Douglas RB-66B.



The de Havilland Firestreak
air-to-air infra-red guided missile
for the military aircraft of the world

DE HAVILLAND PROPELLERS LIMITED

HEAD OFFICE: HATFIELD · HERTFORDSHIRE

V-Bomber

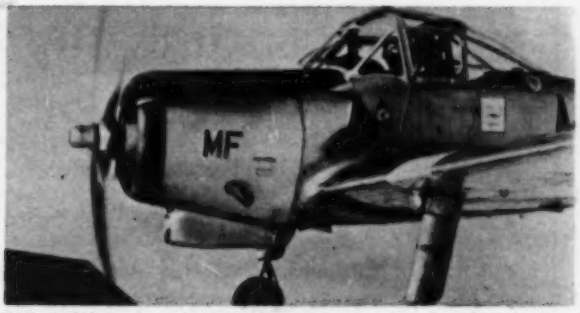
Flying in the Missile Age. The advent of the stand-off bomb (air-to-ground missile, for despatch several hundred miles from a target) greatly enhances the vital role of the V-Bomber Force for many years to come.

Force

To fly Britain's V-Bombers calls for a highly developed sense of responsibility and the men who fly them must also have more than a fair share of skill and initiative . . .

Flying with the Royal Air Force is not easy. To the right young man, however, it has always offered responsibility combined with excitement and variety, and now, in the missile age, there is even greater scope than ever before. How does your career begin? What are the stages you go through, for instance, before you join the V-Bomber Force?

Aircrew selection. First you go for four days to Hornchurch where you do a series of tests to see whether you have the mental and physical qualities it takes to be a pilot, navigator or an air electronics officer. Alertness of mind, as well as quickness of hand and eye, will stand you in good stead for aircrew selection.



Basic training. Once through Hornchurch, you are a potential officer and ready to be introduced to service life and do your basic training. This you finish with the rank of Acting Pilot Officer, and your flying training begins. You learn to fly on the Provost Trainer. You make your first solo flight.

Passing out. You convert to an advanced jet trainer—the Vampire T.11. Advanced flying training takes you to aerobatics, formation flying and instrument flying. Once you successfully complete your course on Vampire jets, the great moment comes, at the passing-out parade, when you step forward for your 'wings'.

Joining a squadron. First you go to an Operational Conversion Unit to learn all about a specific type of bomber. Soon after you qualify you are shaking hands with your new squadron commander. Your life in a bomber squadron has begun.

The Royal Air Force *Flying . . . and a career*

How to join. You can join the R.A.F. through the Direct Commission scheme, which offers you a permanent career right up to pension age, or a twelve-year engagement with the option of leaving after eight. (If you leave after twelve years you take back to civilian life a tax-free gratuity of £4,000). Alternatively, there's a five-year Short Service Commission. Whichever you choose, the pay is good. The new increases in pay and allowances effective from the 5th April mean that a Flight Lieutenant of 25 can, with full allowances, earn more than £1,500 a year.

If you are between 17½ and 26; if you have the General Certificate of Education, the Scottish Leaving Certificate, or their equivalent, then write, stating age and education to the Air Ministry, Dept. FR13a, Adastral House, London, W.C.1. We will send you all you need to know.

A trustworthy service—

The efficient machining of metals presents problems of such importance that we, as specialist oil manufacturers, undertake

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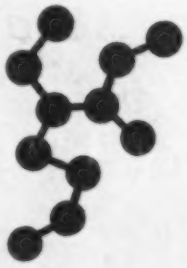

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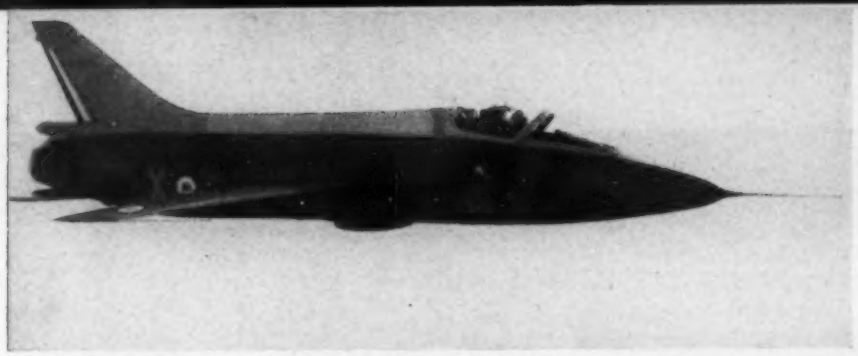


Left, Bréguet 1001 Taon

Below, Dassault Mirage III

INDIA

Hindustan Fighter The only aircraft and engine production unit in India, Hindustan Aircraft is reported to be undertaking the design of a jet trainer and an advanced jet fighter under the present Indian five-year plan. The designer of the fighter is said to be Kurt Tank.

Hindustan HT-2 Production of a considerable batch of these basic trainers for the Indian Air Force and Navy has now been completed and the aircraft has been offered for export to South-East Asian countries. It is a low-wing, tandem two-seat, all-metal trainer powered by a Blackburn Cirrus Major III giving 155 h.p.

Span, 35ft 2in; gross weight, 2,240 lb; cruising speed, 115 m.p.h.; endurance 3.5 hr.

FRANCE

FIGHTERS AND FIGHTER BOMBERS

Bréguet 1001 Taon Designed for the NATO lightweight strike fighter competition, the Taon is powered by a Bristol Orpheus BOr.3. A great deal of wind-tunnel work, some of it in America, went to the development of the aircraft and area rule is fully applied. Extensive use is also made of bonding and honeycomb sandwich in the structure. On April 25 the Taon, piloted by Bernard Witt, set up a new 1,000 km closed-circuit speed record at 539.85 kt.

The Taon, which made its first flight last summer, was preceded by the Br.1100, powered by two Turboméca Gabizos and prepared for a French Air Force specification. It is likely that the Taon, with the more powerful Orpheus BOr.12, will become the standard NATO lightweight strike fighter after 1961. Recent modifications include extra area-rule bulges about the wing leading-edge.

The Taon at present has a very thin wing of 158 sq ft area (when the BOr.12 is fitted, area will be increased to 210 sq ft) carrying wide span, narrow chord flaps and wide-chord, narrow-span ailerons assisted by knife-edge spoilers ahead of the flaps. This ensures a rate of roll of 200 deg/sec at Mach 1 at sea level. The Jacottet controls are fully powered and a Jacottet feel unit is incorporated. A yaw-damper is also included. Armament consists of four 0.5in machine guns under the intakes, a shelf ahead of these preventing ingress of gases. A full range of stores including missiles is carried under the wings.

Span, 22ft 3¼in; length, 36ft 10½in; empty weight, 5,700 lb; max. gross weight, 12,500 lb; max. speed, Mach 1 plus in a dive, Mach 0.97 level; tactical radius, about 200 miles.

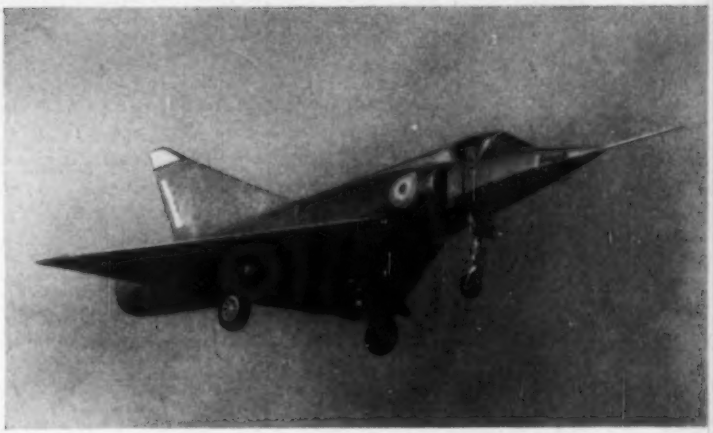
Dassault SMB2 Super Mystère Production of some 370 SMB2s has been under way now for about a year, although recent military budget restrictions indicate that the total number may be reduced by about 80. The first production machine flew on February 26 last year. It was the first production aircraft in Europe capable of exceeding Mach 1 in level flight. Power is provided by a SNECMA Atar 101G with afterburner, giving 9,900 lb static thrust, though the last machines will have the Atar 9 of 13,230 lb thrust.

Armament consists of two 30 mm DEFA cannon and a retractable Matra pack of 35 folding-fin, air-to-air rockets. The latter may be replaced by a fuel tank. Some 2,000 lb of underwing stores may also be carried. Integrally stiffened skin panels and single-piece milled wing-spars are incorporated. The SMB2 was reported by a German pilot to be level-supersonic above 25,000ft. Controls include fully powered ailerons and slab tailplane, yaw stabilizer and possibly also an auto-Mach tailplane control. Radar-ranging and a miniaturized A.I. radar for the SMB2 have been produced by the electronics division of Dassault.

Span, 34ft 5¾in; length, 46ft 1in; weight empty, 15,400 lb; gross weight, clean, 19,840 lb; max. gross weight, 22,046 lb; max. speed at 36,000ft, 743 m.p.h., Mach 1.125; initial rate of climb, 17,500ft/min; ceiling, 55,750ft.

Dassault Etendard IV Marine The prototype made its first flight on May 21 and a pre-production batch is under way. The type is intended for operation from the Clémenceau carriers and can exceed Mach 1 in level flight. A SNECMA Atar 8 of 9,700 lb thrust is fitted and the undercarriage has a stroke of 16in. Low-pressure tyres may also be fitted for operation from grass fields. The low-set swept wing carries a drooping leading edge and high-lift flaps. The extremities of the wing only fold and the ailerons are fitted between the folding hinge and the flaps. Horizontal control is by slab tailplane. The airframe is stated to be area-ruled. No details of dimensions, armament or performance have been released, though it is known that it is larger than the Etendard IV. Carrier-landing speed is reported to be 140 m.p.h.

Dassault Etendard VI An unpressurized, Bristol Orpheus-powered light fighter prepared for the NATO lightweight strike fighter competition, in which it was not successful. Armament was four 0.5in machine guns and underwing stores. Main development effort is probably now concentrated on the IV Marine version of the Etendard.

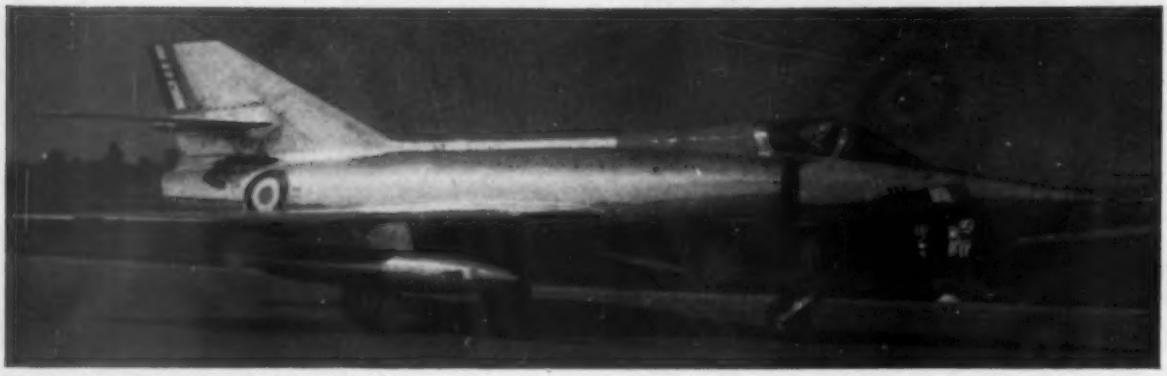


Span, 31ft 6in; length, 47ft 2½in; empty weight, 7,495 lb; gross weight, 14,330 lb; max. Mach no. at sea level, 1.0.

Dassault Mirage III Intensive development of this intercepter is going ahead, the III-001 now carrying adjustable shock-cones in the lateral intakes and a conical camber on the leading edge of the delta wing;

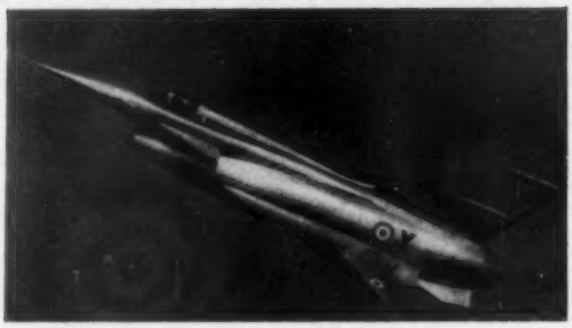
Below, Dassault SMB2 Super Mystère

Below, Dassault Etendard VI



Above, Dassault Etendard IV

Right, Nord 1500 Griffon 2



Military Aircraft of the World . . .

it has reached Mach 1.5 to 1.6 on the level at 36,000ft without the assistance of the jettisonable SEPR two-barrel, two-power rocket pack which is to be standard. Primary propulsion is from a SNECMA Atar G with afterburner. Either a twin 30 mm gun pack or a single missile may be carried; and internal fuel load of 572 gal can be supplemented by two 137-gal wing tanks. These may be replaced by offensive stores. Low-pressure tyres allow take-off from hard ground and landing on grass.

Span, 24ft 11in; length, 41ft 6in; empty weight, 7,715 lb; gross weight, clean, 11,025 lb; max. Mach no. 1.8.

Dassault Mirage IIIa The first of eight pre-production IIIas has now flown. It is reported that 100 production versions have been ordered as intercepters. They will carry either Dassault Aida or Antigone fire-control radars and either a gun-pack or a missile. An afterburning Atar 9 giving 13,230 lb thrust and a two-barrel SEPR rocket giving 6,610 lb thrust will provide power. Wing span has been increased, the trailing edge swept back instead of slightly forward and t/c ratio reduced to 4.5 per cent at the root and 3.4 per cent at the tips. Leading-edge sweep is 60 deg, wing area 365 sq ft and aspect ratio 1.97. Adjustable shock-cones are mounted in the lateral intakes. Fully powered elevons provide lateral and longitudinal control with spring feel. The airframe is area-ruled and the airbrakes consist of small panels hinged to both upper and lower wing surfaces near the leading edge.

Span, 26ft 11in; gross weight, between 13,000 lb and 15,500 lb; max. Mach no., about 2; ceiling, 82,000ft.

Dassault Mirage IIIb This is a two-seat version of the IIIa and is equally capable of performing interception or strike duties. The crew are seated in tandem under a single-piece canopy. Gross weight is increased to 18,500 lb. Construction of a prototype is reported to have begun and there seems to be a possibility of an order in the future. Performance is expected to be approximately the same as that of the IIIa.

Leduc 0.22 Development of this turbojet- and ramjet-powered intercepter has now been discontinued. The SNECMA Atar D.3 turbojet provided power for an independent take-off, after which the Leduc ramjet, which occupied most of the main fuselage space, was lit to provide an equivalent ground-level thrust of 132,000 lb. The pilot was accommodated in a conical, jettisonable nose capsule forming the forward part of the central nacelle housing the Atar. During ramjet flight the Atar was throttled back and provided only shaft power. Wing sweep was 30 deg and a normal nosewheel undercarriage was fitted.

Nord 1500 Griffon 2 Development of this lightweight intercepter appears to be continuing, despite reports that the programme had been cancelled. It is a 60 deg delta with flaps, braking parachute and low-pressure tyres for operation from grass, controlled by powered elevons and a trimming slab foreplane. Powerplant is a SNECMA Atar 101E feeding a Nord ramjet unit; and it is claimed that the 1500 became the first ramjet-powered aircraft in the world to exceed Mach 1 in level flight. The date was May 17 last year.

Span, about 26ft; length, about 46ft; gross weight, about 13,220 lb; max. speed, 930 m.p.h. at 10,800ft.

SNECMA Atar Volant Development of this remarkable Atar-powered VTO machine is continuing with tests of the P.3 version with an enclosed cockpit and a tilting ejection seat. No lifting surfaces have yet been fitted, though Nord are engaged in constructing them. Present vehicles are simply engine pods equipped with gyro-stabilization equipment controlling high-velocity air jets impinging on the turbojet efflux to provide stability and translational flight. Final stage will be the addition of an annular wing containing also fuel tankage, so that the machine will be able to tilt into a horizontal attitude and fly relatively normally. Various intercepter versions have been studied under the designations Charançon VI, Charançon VIII (powered by a Bristol Orpheus) and Hanneton IIIA. No performance details are yet available.

Sud SO.4050 Vautour IIN This is the all-weather fighter version of the Vautour series and is now entering service with the French air force. The crew of two sit in tandem in a pressurized cockpit and have Sud ejection seats. Fire-control radar is fitted together with a very varied armament. Fixed items include a pack of four DEFA 30 mm cannon and up to 232 rockets in the weapons bay. Further honeycomb packs or fuel tanks or Nord 5103 missiles may be carried externally; and all forms of armament are catered for by the automatic fire-control radar supplied by Compagnie Generale de Telegraphie Sans Fil. Dimensions and performance are as stated for the bomber version of the Vautour.

Sud SO.9050 Trident II Powered by an SEPR twin-barrel rocket motor in the tail and two Turboméca Gabizos at the wing-tips, this machine reached a Mach number of 1.95 last year, climbed to 59,055ft in under 200 sec in April this year and set a world height record (since beaten) of 79,724ft last month. Development towards the Trident III intercepter has now been cancelled.

BOMBERS AND STRIKE

Dassault Mirage IV This is the deliberately misleading designation of the Dassault supersonic bomber, first reported in *Flight* for June 7, last year. Very little official information has been released about the machine, but it is believed to have a thin delta wing with two SNECMA Atars in pods suspended beneath it. The aircraft is relatively small and carries a crew of two. The store will probably be carried externally. No performance details are available.

Sud SO.4050 Vautour Now entering service with the French Air Force, the Vautour is being produced in three versions, namely as an

Below, Sud SO.4050 Vautour IIN all-weather fighter

Right, Sud SO.4050 Vautour bomber

Bréguet 1050 Alizé

all-weather fighter, a bomber and a tactical-support aircraft. It has a swept wing carrying two SNECMA Atar 101E3 engines in underslung nacelles. Two main undercarriage units are housed fore and aft of a weapons bay in the fuselage and supported by outriggers retracting into the engine-nacelle flanks. A braking parachute is fitted.

The bomber version carries a single pilot and a bomb-aimer in a transparent nose compartment. Bombs are attached to a rotating platform in the bomb-bay and other stores can be carried under the wings. There is no defensive armament.

The tactical-support version is a single-seater carrying four 30 mm cannon in a gun-pack in the forward fuselage and a variety of stores under the outer wings in addition to a rotating bomb-platform. Packs of up to 240 rockets may be carried in the bomb-bay or these may be replaced by a B.10 guided air-to-ground weapon.

All three versions of the Vautour can exceed Mach 1 in a dive and have considerable range and ceiling.

Span, 49ft 6½in; length, 51ft 1in; max. speed, Mach 0.9 at sea level and 595 m.p.h. at 40,000ft; service ceiling, 44,000ft; time to 39,370ft, 4 min 49 sec; ferrying range, 3,700 miles.

ANTI-SUBMARINE

Bréguet 1050 Alizé A carrier-based anti-submarine search and strike aircraft carrying a crew of three, search radar, sonobuoys, weapons and powered by a Rolls-Royce Dart RDa.7. An order for 75 has been placed and construction is well under way. The radome retracts into the rear fuselage, and the main units of the nosewheel undercarriage retract into pods on the wings which also accommodate equipment. Flare- and buoy-chutes are located in the fuselage flanks, just aft of the cabin section.

Span, 50ft 2in; length, 45ft; gross weight, 17,640 lb; endurance over 4 hr; max. range 1,550 miles; patrol speed, between 140 and 205 m.p.h.

TRANSPORTS

Bréguet 765 Sahara The military version of the Bréguet Deux Ponts, which has seen extensive civil service during past years. Certain modifications are incorporated to suit the machine for military cargo carrying and P. and W. R-2800-CB-16 or CB-17 engines are fitted. Trials have established ability to parachute heavy loads. One hundred and fifty paratroops have been dropped, a fully equipped battery of 105 mm guns carried, or an AMX medium tank.

Span, 140ft 5in; length, 94ft 11in; empty weight, 68,343 lb; max. gross weight, 119,050 lb; take-off to 50ft, 5,100ft; range, with allowances, using tip-tanks, 2,930 miles.

Bréguet Intégral The aerodynamic test version for this STOL transport has now flown and development of a rather larger military version is under way. Lift is obtained for near-vertical take-off by bathing the whole wing in the slipstream from four large propellers coupled to a transverse transmission shaft. The slipstream is also deflected vertically downwards by large double-slotted flaps and drooping double-slotted ailerons. The elevator, too, is double-slotted, and droops in unison with the flaps. Four Turboméca Turmos, giving 450 h.p. each, drive through their free turbines into the transverse transmission, so that failure of one engine will not cause one propeller to stop rotating. A crew of two sit side-by-side in a fully glazed nose compartment, ahead of a large cargo hold having rear-loading doors. The undercarriage of the military version will probably retract into bulges alongside the fuselage. Versions are foreseen with either General Electric T58s or Lycoming T53s.

GENERAL PURPOSE, LIAISON AND SPOTTING

Max Holste MH.1521 Broussard Designed originally as a private venture, the Broussard was adopted by the French forces and 350 of them have been ordered for utility and command liaison work. Possible loads include army radio, cameras, stretchers, passengers or cargo. The high-set, rigidly braced, all-metal, torsion box wing carries slotted flaps, slats and ailerons, the latter arranged to droop to 13 deg when flaps are lowered to 45 deg. Twin fins and rudders are fitted; and the undercarriage legs are spring steel units made under Cessna licence. Power is by Pratt and Whitney R-985, giving 450 h.p., with a Hamilton Standard propeller. A handling report appeared in *Flight* for March 23, 1956.

Span, 45ft 1in; length, 28ft 2in; empty weight, 3,256 lb; gross weight, 5,500 lb; max. speed, 168 m.p.h.; econ. cruising speed, 143 m.p.h.; minimum speed, 53 m.p.h.; take-off to 50ft, 1,066ft; service ceiling, 19,030ft; max. range, 745 miles.

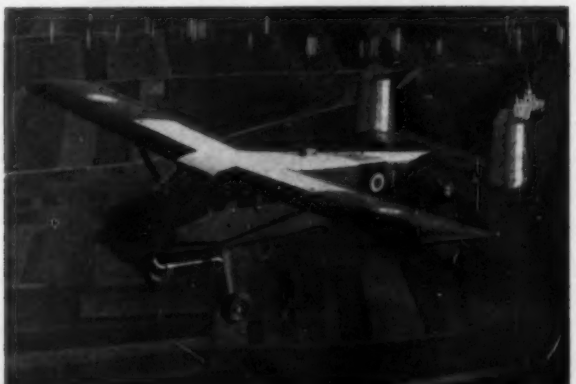
Max Holste MH.250 Super Broussard A military order has been placed for a number of prototypes of this twin-engined, short-field transport. Mock-ups of the cabin section were shown at the Paris show last year. Capable of carrying 17-20 passengers or 4,122 lb of freight and having rear-loading doors, it will be an all-metal, high-wing monoplane powered initially by two P. and W. R-1340s giving 600 h.p. each and later by two Turboméca Bastans of 650 h.p. each. High-lift devices including full-span slats are incorporated to ensure excellent short-field performance. A semi-retractable nosewheel undercarriage, the main bogies of which retract partially into fuselage bulges, is to be fitted.

Span, 70ft 1in; length, 51ft 10in; empty weight, 8,850 lb; gross weight, 14,603 lb; max. speed, 225 m.p.h.; econ. cruising speed at 9,000ft, 174 m.p.h.; stalling speed, 63 m.p.h.; take-off to 50ft, 1,050ft; normal range with reserves, 603 miles.

Right, Nord 2501 Noratlas

Below, Bréguet 940 Integral

Below right, Max Holste MH.1521 Broussard



Morane MS.1500 Epervier

Above, Nord 3400

Below, Sipa 1100

Military Aircraft of the World . . .

Morane MS.1500 Epervier Although it was reported that the contract had been cancelled as soon as the prototype had flown, development appears to be continuing. The first machine, which flew on May 12, is powered by a Turboméca Marcadau turboprop, but production versions would have the more powerful Bastan, giving 650 h.p. The machine is designed for observation and ground-attack duties and is intended to be able to operate from unprepared fields. The crew of two sit in tandem under an ample sliding canopy, with the pilot behind. This affords a completely clear view for missile firing for the observer in front. Leading-edge slats and large flaps are fitted. A telescopic control column and folding rudder pedals in the front compartment allow for dual control, if required. The undercarriage is fixed and armour protection is provided for the crew.

Span, 42ft 9in; length, 34ft 9in; empty weight, 3,863 lb; gross weight, 6,071 lb; max. speed, 197 m.p.h.; stalling speed, 55 m.p.h.; take-off run, 394ft; range, with 45 min reserve, 732 miles.

Nord 3400 Designed to a French army specification issued in 1956, construction of the 3400 was begun in January 1957 and the first flight was made by Turcat on January 20. Military rôles include observation, ambulance and attack, for which the rear seat swivels through 360 deg, a stretcher door is provided and armour can be fitted, together with underwing stores racks. The wings can be folded for storage or road transport. Dual controls are fitted for the two occupants in tandem. The single-spar wing is mostly fabric-covered, while the fuselage is made up of steel tube and fabric. Slotted flaps (operated by hydraulic hand-pump) and ailerons both droop to about 45 deg. The engine is a 240 h.p. Potez 4-D 30.

Span, 41ft 8in; length, 27ft 8in; empty weight, 2,028 lb; gross weight, 2,976 lb; max. speed, 124 m.p.h.; min. speed, 44 m.p.h.; take-off and landing runs, 100 yd; range 620 miles.

Sipa 1100 Ten prototypes were reported to have been ordered, but it is thought that the contract was cancelled as soon as the aircraft had flown. Nevertheless, development is apparently continuing. The aircraft is a three-seat monoplane, with retractable tailwheel undercarriage and powered by two P. and W. R-1340s giving 600 h.p. each. The crew compartment in the nose is extensively glazed to afford all-round visibility; and provision is made for the carriage of standard armament stores.

Sud Aviation SE.116 Voltigeur Though no previous mention had been made of this aircraft, it made its first flight at Marignane on June 5. It is a remarkable low-wing, two-seater, monoplane powered by two Turboméca Bastan turboprops giving 650 h.p. each. A single fin is fitted; and the cruising speed is reported to be no less than 280 m.p.h. Airbrakes are fitted in the sides of the fuselage. New structural methods, designed to produce a light, strong structure and ensure ease of manufacture have been applied. The cabin has generous window area and the nosewheel undercarriage carries twin mainwheels. The Voltigeur is designed for liaison work from short, unimproved fields.

Span, 54ft 10in; length, 38ft 1in.

Sud SE.3130 Alouette 2 Some 200 of these five-seat helicopters have been ordered by the French Navy and Army for general duties, including ambulance, observation and liaison. Successful trials have also been conducted with armed versions carrying six Nord SS.11 anti-tank missiles on outriggers. Either wheel, skid or float landing gear may be fitted. Power is provided by a Turboméca Artouste 2 shaft-drive turbine giving 320 h.p. The engine is set by a separate throttle to run at a governed speed of 36,000 r.p.m., constant speed being maintained by automatic fuel control operated by the movement of the cyclic-pitch control lever. This greatly simplifies flying. The Alouette has excellent manœuvrability and can land at points well over 10,000ft above sea level. Recent developments have increased engine power and payload considerably.

Rotor diameter, 33ft 6in; length, 31ft 10in; empty weight, 1,874 lb; gross weight, 3,300 lb (3,600 lb in latest machines); max. payload for restricted range, 1,047 lb; cruising speed, 106 m.p.h.; max. range, 370 miles.

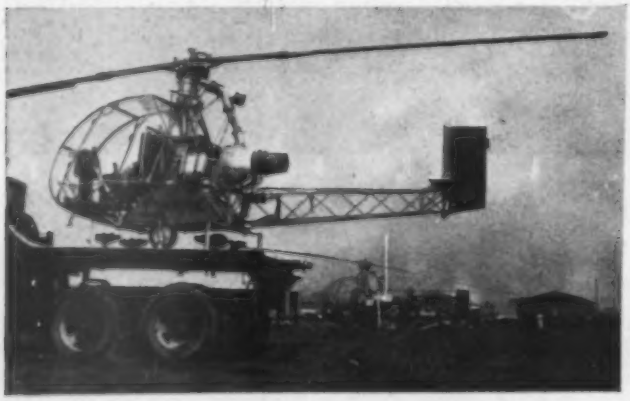
Sud SO.1221 Djinn A two-seat, general purpose helicopter driven by pressure jets at the blade tips supplied by a Turboméca Palouste IV air generator giving 240 h.p. About 150 have been ordered for the French army and air force. It is used for liaison, observation and ambulance work; and it has also been fitted with Nord SS.10 anti-tank missiles mounted on outriggers. The Palouste can be started by hand, the starting cycle being controlled from outside by the pilot who climbs in after the engine is running normally. Directional control is by a rudder mounted above the tail boom and in the engine efflux. There is no anti-torque rotor. A variety of loads such as stretchers may be carried on the undercarriage supports.

Rotor diameter, 36ft 1in; fuselage length, 17ft 4in; empty weight, 728 lb; max. gross weight, 1,765 lb; max. speed, 80 m.p.h.; cruising speed, 66 m.p.h.; cruising range, 112 miles.

TRAINERS

Fouga CM.170R Magister The standard intermediate trainer for the French air force, by whom 257 have been ordered. Power is provided by two Turboméca Marboré 2 engines and the crew are accommodated in tandem in a pressurized cabin. Machine guns and bombs or rockets may be carried, the instructor sighting through a binocular periscope which

Sud SO.1221 Djinn



Sud 3130 Alouette II carrying SS.11 missiles

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These words of the Air Officer Commanding No. 1 Group, Bomber Command, summarise the fine impression the Avro Vulcan has created in its first year of service with the Royal Air Force. Commenting on the fine performance of the Vulcan "both from the operating and the maintenance aspects", he went on to say: "The way in which the large aircraft and its complex system has been brought into use in the front line of Bomber Command, without any of the enforced groundings so frequently experienced with new types of aircraft, is most gratifying." Popular with air and ground crews alike, the Avro Vulcan—almost certainly the world's fastest and most effective operational bomber—has become in one short year the spearhead of Britain's air power.

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Above, Fouga CM.170R Magister.

Right, Fiat G.91.

Military Aircraft of the World . . .

also provides him with general forward vision over the top of the hood.

Of 250 Magisters ordered for the German air force and now being built by Heinkel and Messerschmitt in Germany, 40 are being delivered complete by Fouga. The Israel company, Bedek Aircraft, Ltd., also have a construction licence.

Span, without tip-tanks, 37ft 2in; length, 33ft; empty weight, 4,740 lb; normal gross weight, 6,614 lb; max. speed at 23,000ft, 441 m.p.h.; service ceiling, 40,000ft; time to 19,700ft, 10 min; take-off to 50ft, 2,890ft; landing from 50ft, 2,690ft.

Fouga CM.175 Esquif This is a navalized version of the CM.170R, fitted for carrier duties with two-part sliding canopy, long-stroke, pre-retracting undercarriage, catapult spools and an arrester hook. Two prototypes have visited R.A.E. Bedford for simulated deck trials and have made actual carrier landings on a British carrier in the Mediterranean. A first batch of 30 has been ordered. Dimensions and performance are equivalent to those of the 170R.

GERMANY

Dornier Do 27 For the West German Army the Dornier factory near Munich is producing a total of 428 Do 27s at a rate approaching a score a month. Single-control utility and some dual-control trainer versions are in hand. With the designation Do 25, the aircraft was originally produced by Oficinas Tecnicas Dornier in Spain in June 1954. The first Do 27, powered by the standard Lycoming GO-480 of 270 h.p., flew in Germany in October 1956. Well over 100 have been delivered to date.

Structure is simple, with a cantilever wing, unbraced undercarriage and semi-monocoque tail. The wing carries a fixed slot over its entire leading edge and has double-slotted flaps and ailerons. The latter are divided into two sections each side, the inboard sections drooping progressively to half the full-flap deflection angle. Airflow-breakaway in the all-down configuration is thus minimized; and quite remarkable slow-flying qualities have often been publicly demonstrated (they were described at first hand by C. M. Lambert in *Flight* for June 14 last year). Tailplane incidence is variable. German military Do 27s are fitted with five seats and equipped for communications and photography. Cabin volume is 123.6 cu ft.

Span, 39ft 4in; length, 31ft 4in; wing area, 208.8 sq ft; empty weight, 2,172 lb; gross weight, 3,307 lb normal, 3,528 lb maximum, 3,793 lb agricultural overload. Performance at normal gross weight: max. speed, 155 m.p.h.; cruising speed 127 m.p.h.; minimum speed, 35.5 m.p.h.; take-off to 50ft, 541ft; still-air landing run, 246ft; ceiling, 18,000ft; range, 541 miles.

ITALY

FIGHTERS AND FIGHTER/BOMBERS

Fiat G.91 This machine is now officially standardized as the NATO lightweight strike fighter until 1962, when it will be superseded by a French type. Bearing a marked external resemblance to the North American F-86K, produced under licence by Fiat, it is powered by a Bristol Orpheus BOr.3 giving 4,850 lb thrust. Fixed armament consists of four 0.5in machine guns mounted on fold-out panels either side of the single-seat cockpit. In addition, a great variety of stores, including a tactical nuclear weapon, air-to-ground missiles and extra fuel tanks, may be carried on two underwing pylons. Ailerons and elevator are fully powered, tailplane incidence is variable and a large double airbrake is fitted under the fuselage. The pilot is accommodated in a pressurized and air-conditioned cabin and sits on a Martin-Baker Mk 4 ejection seat. Maximum level speed is in the high sub-sonic region, though Mach 1 can comfortably be exceeded in a dive.

Low-pressure tyres allow the G.91 to operate from relatively unprepared ground in the forward areas; and maintenance and servicing have been specially arranged so that they can be done in the field with the minimum of manpower and equipment.

A total of 150 G.91s have been ordered in equal numbers by France, Italy and Germany; and there appears to be a possibility that a further quantity may be built under licence by a German company. In addition, three prototypes have flown and a pre-production batch of 27 for field evaluation, including two G.91Ts and four G.91Rs, is under way.

The Fiat G.91A is a more advanced version fitted with automatic leading-edge slats and integral tankage in the wings holding a further 80 gal. Wing span has been increased to add 17 sq ft; and t/c ratio is reduced to 9 per cent. Range is thus increased by 10 per cent and required field length decreased by 2.5 per cent.

Span, 28ft 1in; length, 36ft 5in; sweep at 25 per cent chord, 37 deg; gross weight, 10,360 lb without stores; max. level speed at sea level, 580 kt; max. level Mach number at 20,000ft, 0.91; acceleration at 5,000ft, 280 kt to 400 kt in 30 sec; stalling speed, about 110 kt; take-off run with and without stores, 2,000ft and 1,575ft.

Fiat G.91S A future development of the G.91, this machine will be powered either by the Bristol Orpheus BOr.12 giving 6,800 lb thrust or by the three-bearing Fiat 4032. Wing sweep is increased to 38 deg, t/c ratio decreased to 8 per cent and gross weight increased to 12,790 lb. Maximum level Mach number will be 0.94.

Fiat G.91R Now under development is the reconnaissance version of the G.91 fighter. It differs from the standard machine principally in having a nose section specially adapted for the carriage of a group of vertical and oblique cameras. Four prototypes are being made.

Aerfer Sagittario 2 Outsider among the lightweight fighters, the Sagittario first flew in June 1956 and has been under development since. It is a single-seater intended for tactical support and intercepter duties and is powered by a Rolls-Royce Derwent 9 giving 3,600 lb thrust. Even with this low power, the Sagittario reached Mach 1.1 in a dive from 45,000ft. The engine is mounted in the nose, with the efflux emerging under the fuselage. Fuel is carried in several tanks behind the cockpit. Gross wing area is 158.5 sq ft, aspect ratio 3.82 and sweep angle at quarter chord, 41 deg. The pilot sits in a Martin-Baker Mk 4 ejection seat under a clam-shell canopy. Two 30 mm cannon are mounted under the forward fuselage decking. Flying controls are fully powered, with manual reversion, by Fairey Hydroboosters.

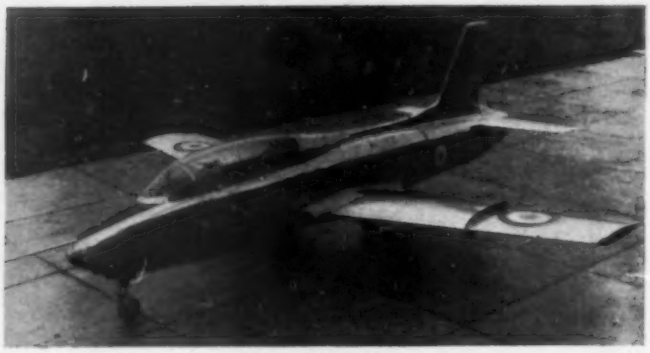
Underwing pylons allow the carriage of two 500 lb bombs, or two Napalm tanks, or 12 × 3in rockets or two extra guns mounted in special detachable packs.

Span, 24ft 7in; length, 31ft 2in; gross weight, 7,260 lb; wing loading,

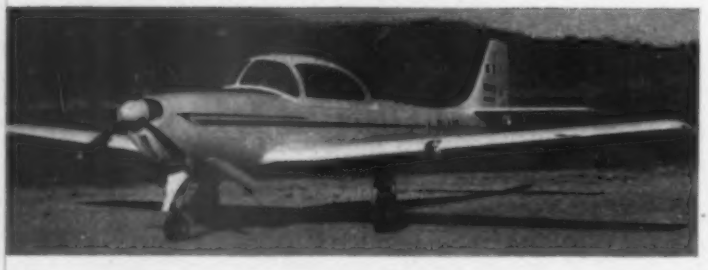
Dornier Do 27.

Aerfer Sagittario 2.

Aerfer Ariete.



Macchi MB.326.



Above, Piaggio P.149D.

Below, a model of the Piaggio P.155-AS.

Military Aircraft of the World . . .

46.5 lb/sq ft; max. speed, 625 m.p.h.; time to 39,370ft, 10 min; service ceiling, 46,000ft; take-off distance, 1,470ft; landing distance, 1,640ft; range, with underwing tanks, 1,240 miles.

Aerfer Ariete Second stage in the Aerfer light-fighter development programme is the Ariete, which differs mainly from its predecessor in having a Rolls-Royce Soar RSr.2 mounted in the rear-fuselage. It breathes through a retractable intake in the top of the fuselage. The Ariete has flown but no performance figures have been released. The first flight was made in April this year.

Aerfer Leone This is the final stage in development and, though no firm details have been released and the prototype is some way off, the powerplant is thought to be a combination of a de Havilland Gyron Junior and a D.H. Spectre controllable-thrust rocket. It should climb to 65,000ft in 2 min, carrying two missiles (possibly de Havilland Firestreaks) under the wings.

TRAINERS

Fiat G.91T This is the tandem two-seat trainer version of the standard fighter. Instructor and student are accommodated in ejection seats under a single-piece blown canopy. Apart from the slight lengthening and other modifications in the cockpit area, the trainer differs little from the fighter except in having the derated training Orpheus BOr.4 giving 4,250 lb thrust. A pre-production batch of 18 has been ordered in addition to two prototypes.

Macchi MB.326 The prototype of this tandem two-seat jet basic trainer has now been flying since December and development continues. Power is provided by an Armstrong-Siddeley Viper ASV.8 giving 1,750 lb thrust. Instructor and student are accommodated in Martin-Baker Mk 4 ejection seats in a pressurized and air-conditioned cockpit under a single-piece, plastic canopy. Armament of bombs and rockets may be carried under the wings; and two machine guns may be installed in the under-fuselage.

Span, 32ft 9.5in; length, 33ft 9in; wing area, 204.5 sq ft; empty weight, 4,299 lb; gross weight, unarmed, 6,283 lb; max. speed, at 29,500ft, 450 m.p.h.; minimum speed, 80 m.p.h.; climb to 19,700ft, 9 min; take-off run, 1,640ft; range at 29,500ft, 826 miles.

Piaggio P.149D The latest version of this excellent trainer aircraft is powered by the licence-built Lycoming GO-480-B engine giving 270 h.p. and can carry five occupants for normal flights and two during aerobatics. The propeller is a three-bladed, constant-speed unit designed and made by Piaggio. Structure is all-metal, with a sliding, full-view canopy and a retractable nosewheel undercarriage. A civil version, differing mainly from the military in having spectacle-type instead of vertical control gear, is also available.

Piaggio have now delivered most of the 75 P.149Ds ordered by the German air force as primary trainers: another 196 are being produced under licence by Focke-Wulf in Germany.

Span, 36ft 6in; length, 28ft 10.5in; wing area, 202.5 sq ft; empty weight, 2,557 lb; normal and aerobatic gross weight, 3,704 lb and 3,197 lb; max. speed, 190 m.p.h.; cruising speed, 167 m.p.h.; minimum stalling speed, 59 m.p.h.; take-off to 50ft at max. weight, 1,312ft; landing from 50ft, 1,017ft; range, 677 miles.

GENERAL PURPOSE

Piaggio P.155 Three versions—two military and one civil transport—of this flying-boat were first revealed in model form at the Paris Show last year. Principal variations are in internal arrangement and powerplant. The SAM-1 variant, a prototype of which is due to be completed next year, will have two Pratt and Whitney R-2800 piston engines giving a cruising speed of between 160 and 220 m.p.h. while the P.155-AS anti-submarine version will have two turboprops and possibly two turbojets in the tails of the nacelles.

The P.155-SAM-1 has a hull of high length-to-beam ratio with a single step planing bottom. Slightly gulled, the high-aspect-ratio wings carry a fixed float near each tip. The fin is slightly swept and carries the tailplane half way up. The engines are mounted well above the wing. Crew complement will be seven, with accommodation for ten stretcher cases and five or ten further passengers. No details of performance or weight have been released. An amphibious version with tandem main gear units in the hull has been mentioned.

JAPAN

Fuji Heavy Industries T1F A contract for an intermediate jet trainer was placed with Fuji in July 1956, after a design competition. The engine was intended to be the Japanese-designed J-3, but as this was not ready in time for the T1F-1 the prototype was fitted with a Bristol Orpheus BOr.1 and designated T1F-2. It was rolled out on November 20, 1957, and first flew on January 19. The second prototype should now be complete and both aircraft handed over for evaluation to the Japanese Air Self Defence Force. It is intended that the T1F-1 should become the standard intermediate trainer for the A.S.D.F.

Span, 34ft 5in; length, 38ft 10in; sweep at 25 per cent chord, 26.7 deg; gross weight, 7,880 lb; max. speed at 20,000ft, 420 kt; time to 33,000ft, under 13 min; service ceiling, over 40,000ft; endurance, over 2 hr; take-off to 50ft, 1,970ft; landing from 50ft, 2,950ft.

Fuji T1F-2.

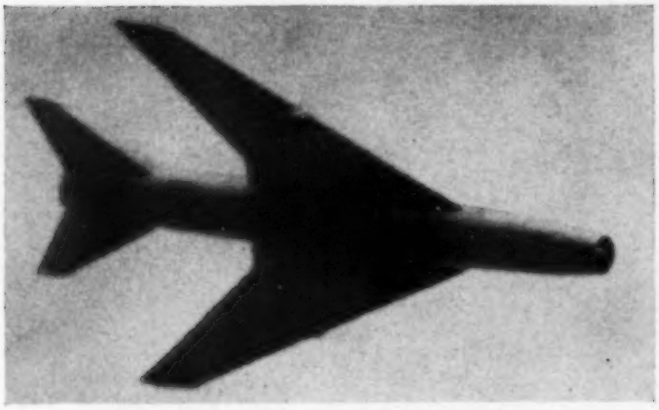
U.S.S.R.

FIGHTERS AND FIGHTER/BOMBERS

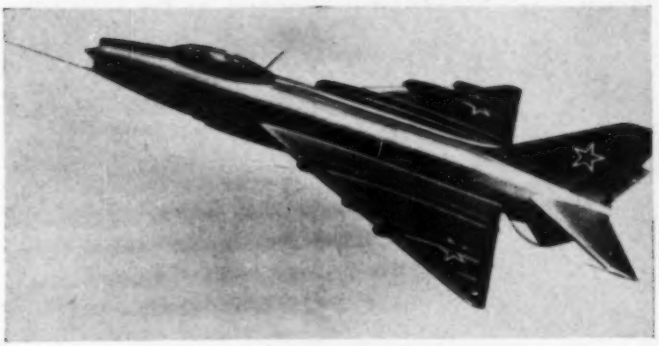
"Faceplate" (Mig-21) This supersonic fighter is a much-developed "Farmer" and is powered with a single axial-flow turbojet having an afterburner. A fairing under the tail might house an auxiliary rocket and maximum speed should be between Mach 1.5 and Mach 2. A ceiling of 60,000ft should be attainable and gross weight is at least 20,000 lb.

"Farmer" (Mig-19) A widely used fighter and fighter/bomber, this twin-jet Mig is supersonic in level flight and is armed with two or more guns and possibly air-to-air rocket projectiles. Loaded weight should be of the order of 20,000 lb. A photograph on page 860 shows that experiments have been made with the zero-length launching of aircraft of this type.

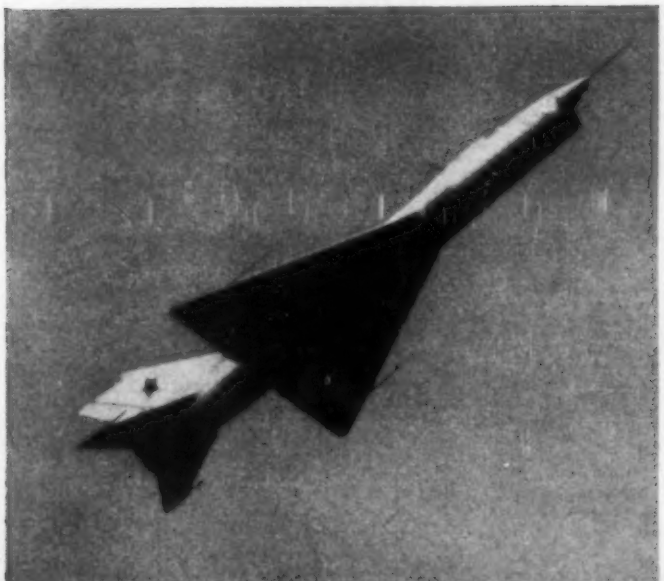
Below, "Fitter."



Below, "Fishbed B."



Below, "Fishpot."



"Fishbed A" The delta wing of this experimental Sukhoi fighter has pointed tips; the nose intake has a shock cone and there is a bulge beneath the rear fuselage. Although a delta, "Fishbed A" has a horizontal tail, mounted on top of the fuselage.

"Fishbed B" An experimental fighter resembling "Fishbed A" but distinguished by slightly blunted wing-tips and possibly by differences in fuselage form.

"Fishpot" Another delta by Sukhoi, this experimental fighter has a long, very clean, fuselage and a chin-type intake for the large axial-flow turbojet, with afterburner. Speed is probably of the order of Mach 2, and weight should approach 20,000 lb. Essential characteristics are seen in the photograph at lower left. "Fishpot" has almost certainly been adopted as a standard type by the Soviet Air Force, and the form of its intake suggests fire-control radar.

"Fitter" Attributed to Sukhoi, this swept-wing fighter is distinguished in having a straight trailing edge on the inboard wing sections. Mach number should be in the 1.5-2 bracket. The single axial-flow turbojet has an afterburner, and there is a "bullet" fairing in the annular nose intake.

"Flashlight A" (Yak-25) A standard all-weather fighter (it entered service in 1955), the Yak-25 is powered by two axial-flow turbojets probably in the 8,000 lb to 9,000 lb thrust range. The main undercarriage units are in tandem and are fuselage-mounted; outriggers are housed in the wing-tip fairings. In addition to gun armament there is provision for a battery of air-to-air unguided rockets. Pilot and radar operator are seated in tandem.

"Flashlight C" In this development of the Yak-25 the turbojets are fitted with afterburners and the nose is extended and pointed. A dorsal spine is another distinguishing characteristic.

"Fresco" (Mig-17) Several variants of this standard fighter/bomber are in service in the Soviet Union and satellite countries. "Fresco A" was the original production type with VK-1 turbojet of about 6,000 lb thrust and with tail-mounted air brakes. "Fresco B" has air brakes mounted farther forward and "Fresco C" has a later development of the VK-1, with reheat. "Fresco D" is an all-weather version and "Fresco E" is similar but has reheat. All the later variants have provision for under-wing tanks.

Span, 36ft; gross weight, 12,000-13,000 lb; level Mach number, about .98; ceiling, 60,000ft approx.

BOMBERS AND STRIKE

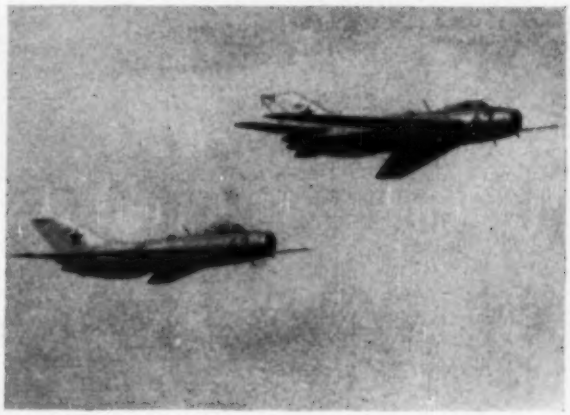
"Backfin" Russia's first supersonic bomber, "Backfin" has two axial-flow turbojets mounted in the fuselage and fed by flank intakes situated between the cockpit and the leading edge of the swept wing. A Mach number of at least 1.5 should be attainable. Remotely controlled armament may be housed in a fairing near the base of the fin.

"Badger" (Tu-16?) This twin-jet medium bomber is used by the Soviet Air Force and Navy and has two axial-flow turbojets of approximately 20,000 lb thrust each. Armament is contained in dorsal, ventral and tail barbettes, and there are sighting blisters in the sides of the rear fuselage. The undercarriage bogies retract into prominent wing fairings. Maximum speed is well in excess of 600 m.p.h.

"Beagle" (Il-28) This straight-wing light bomber and attack aircraft continues in service. It has two centrifugal turbojets of the VK-1 type. There are two fixed forward-firing guns and two additional guns in a tail turret. Top speed is less than 600 m.p.h.

"Bear" Generally attributed to the designer Tupolev, "Bear" is a very large turboprop bomber of about 180ft span and having a swept-back wing. Cruising speed is about 500 m.p.h. and range probably of the

Below, "Farmers" (Mig-19).



order of 7,000-8,000 miles. The main undercarriage units retract into the tails of the inboard nacelles and armament is concentrated in dorsal, ventral and tail emplacements. As in "Badger" there are sighting blisters in the rear fuselage. The turboprops have a rating of at least 12,000 s.h.p.

"Bison" Russia's standard heavy jet bomber, "Bison" has four root-mounted axial-flow turbojets of about 20,000 lb thrust each. It is fractionally smaller than "Bear," having a span of about 170ft, but is rather faster, the top speed of at least 600 m.p.h. There are twin-gun barbettes in the tail, above the fuselage and under the nose. The main undercarriage is of tandem design and there are wing-tip outriggers. Provision can be made for flight refuelling.

"Blowlamp" Having certain design characteristics in common with the Douglas Skywarrior, "Blowlamp" has two pod-mounted turbojets, each of over 10,000 lb thrust. There is a visual bomb-sighting station in the nose and a tail gun position. It is thought that the aircraft has been developed particularly with a view to employment at low level. The main undercarriage is of tandem layout. Speed is described as transonic.

"Boot" An anti-submarine/strike aircraft for naval use, "Boot" has a turboprop of about 4,000 h.p. The crew are housed beneath a long forward-placed canopy, and the war load is thought to be carried both internally and externally.

"Bosun" An obsolescent straight-wing naval torpedo bomber, "Bosun" resembles the Il-28 in general layout and has a similar powerplant. There is a rear turret and bombs and depth charges can be carried as alternatives to torpedoes.

"Brawny" A low-level attack aircraft, "Brawny" is a straight-wing, two-seater, twin-jet aircraft with fixed guns in the nose and free guns in the dorsal and stern positions. Heavy armour-plate protection is likely.

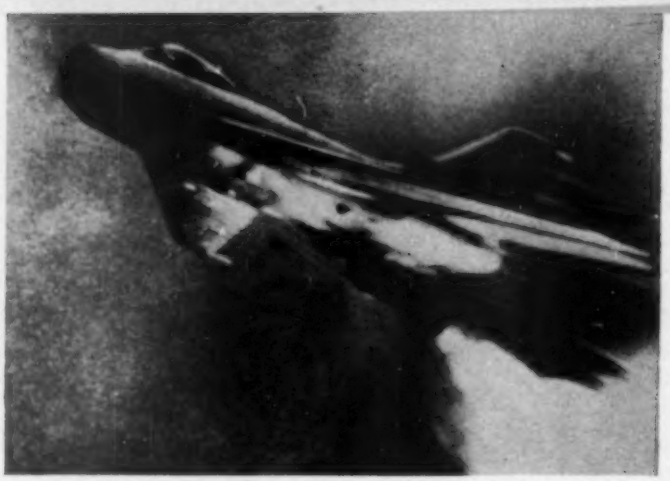
"Flashlight B" This is the bomber member of the "Flashlight" family and is distinguished by a transparent station for the bomb-aimer in the pointed nose. There are no large external gun fairings as on the fighter variants.

TRANSPORTS

"Camp" (An-4) A troop and freight transport of recent design and of trim appearance, "Camp" has two turboprops each of about 5,000 h.p. There are rear loading facilities and the undercarriage retracts into lateral fairings as on the Lockheed C-130. An unusual feature, in a military transport, is the tail gun position. Troop capacity has been reported as 40, but the machine is evidently capable of carrying considerably greater numbers.

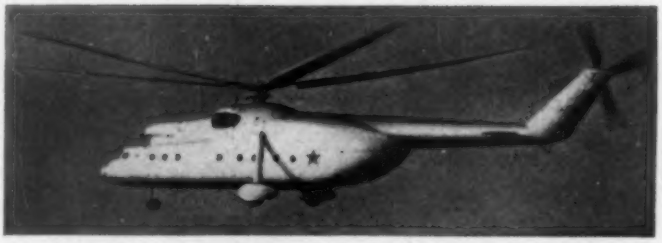
"Hook" (Mi-6) This is the world's largest helicopter and is in production for the Soviet armed forces. The turbines are of the 4,700 h.p. TB-2BM type with drive-output shafts at the rear ends. In general layout the machine resembles the Westland Westminster. Already the Mi-6 has been brought to a state of development where it has gained a number of world records under observed conditions. On October 30 last one of these machines climbed to 7,874ft with a load of 26,464 lb, and indicative of its troop capacity was a Soviet announcement stating that the Mi-6 can carry 70-80 passengers. Heavy equipment and vehicles can be loaded through the rear doors.

"Horse" (Yak-24) This twin-rotor helicopter has two 1,700 h.p. ASH-82V fourteen-cylinder radial engines driving rotors similar to those on the smaller Mi-4. Combined with the rear section of the fuselage is a loading ramp for wheel or track vehicles and heavy military equipment. The cabin measures some 33ft in length and will accommodate two lorries or jeeps, a twin 14.5 mm anti-aircraft gun with its crew, or as many as 40 troops with their service equipment. During December 1955 a Yak-24 lifted a load of two metric tons to a height of 16,670ft.



Above, zero-length launch of a "Farmer" (Mig-19).

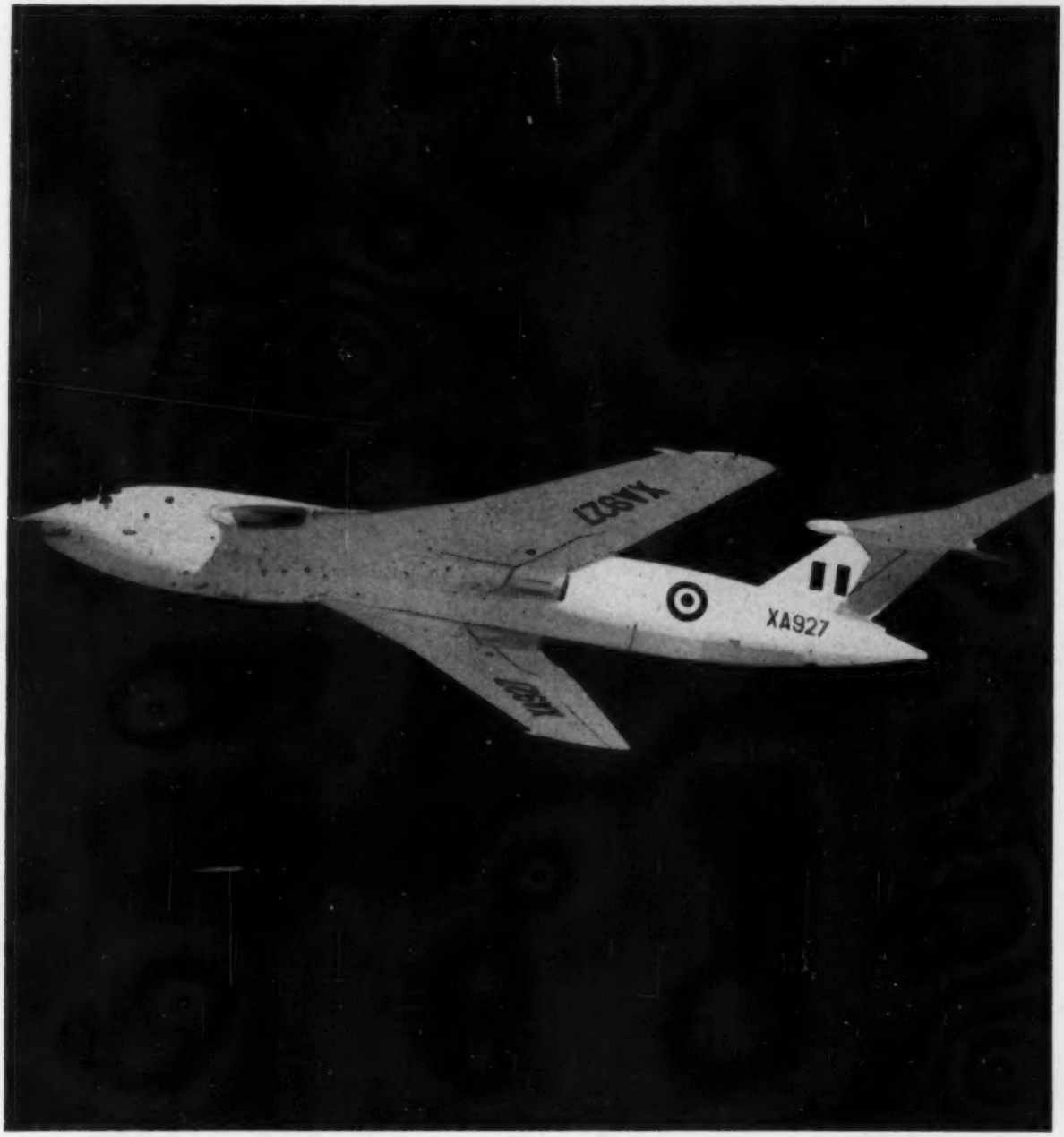
Below, "Flashlight C."



Above, "Hook" (Mi-6). Below, "Camp" (An-4).

Below, "Horse" (Yak-24).

VICTOR

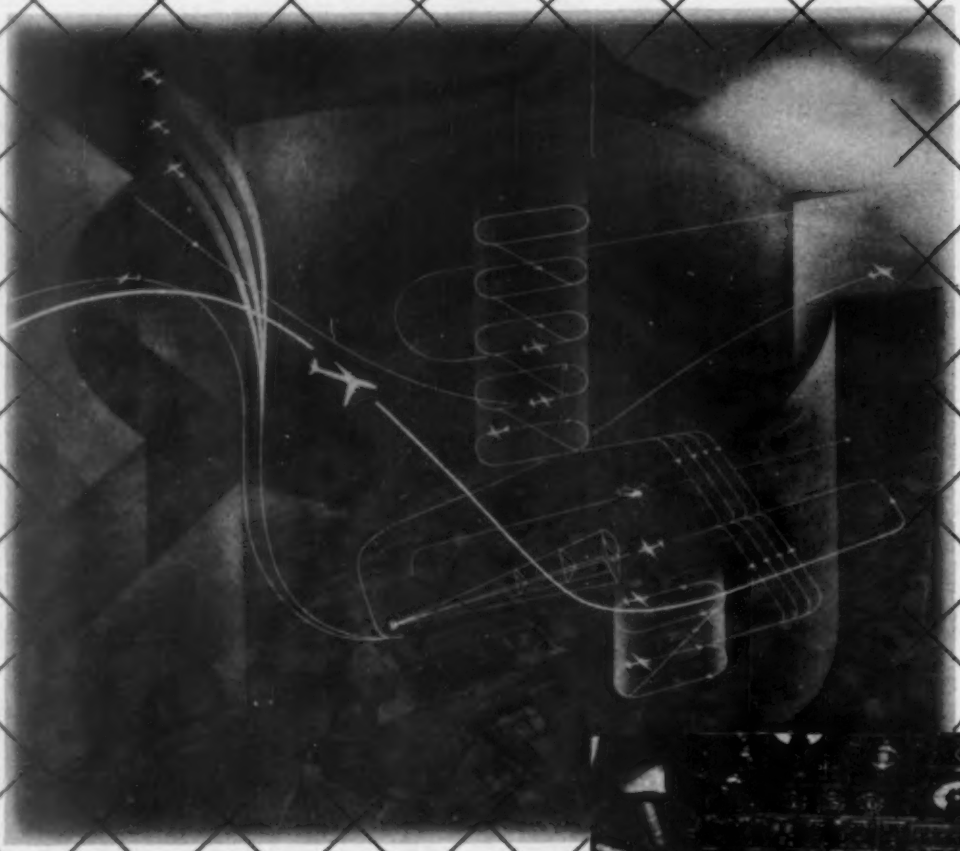


Another Victor, painted a distinctive anti-flash white, enters service. This crescent-winged V-bomber is being flown at height by its R.A.F. crew.

IN SQUADRON SERVICE WITH THE ROYAL AIR FORCE

HANDLEY PAGE

RADLETT · LONDON · READING



Decca in the Jet Age

As more high-performance turbo-prop and turbo-jet aircraft come into service, so the problems of Air Traffic Control become more acute. For these aircraft, precise navigation is more than ever the paramount need if they are to climb and descend safely through varying levels of medium and low altitude aircraft.

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The Decca Navigator can do much to reduce separation standards, so essential to economical use of air space. Indeed, it is the inherent precision and reliability of the Decca System that adds to the safety of high-performance aircraft, both in terminal areas and en route.

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THE DECCA NAVIGATOR

THE WORLD'S MOST ACCURATE NAVIGATION SYSTEM

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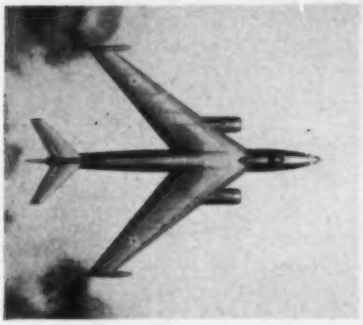
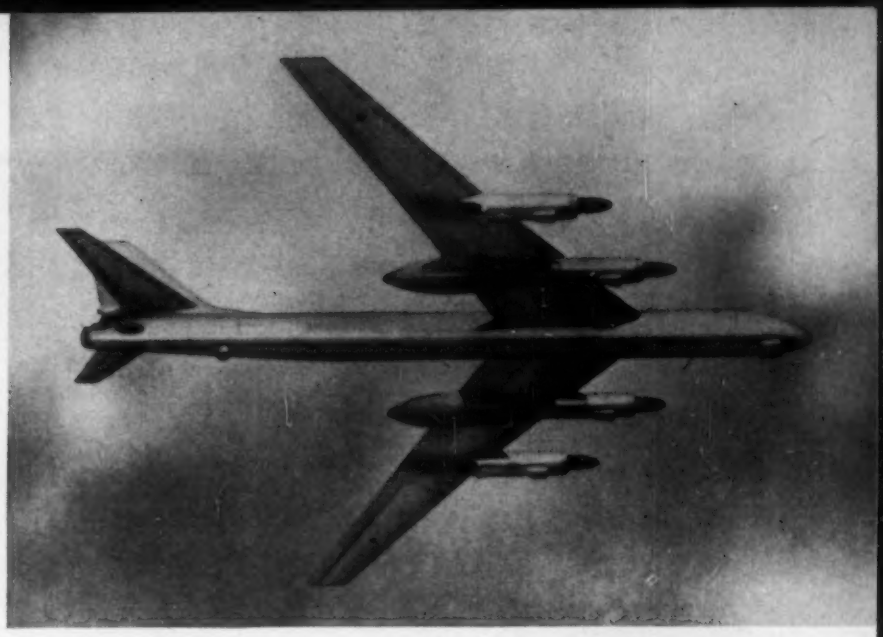


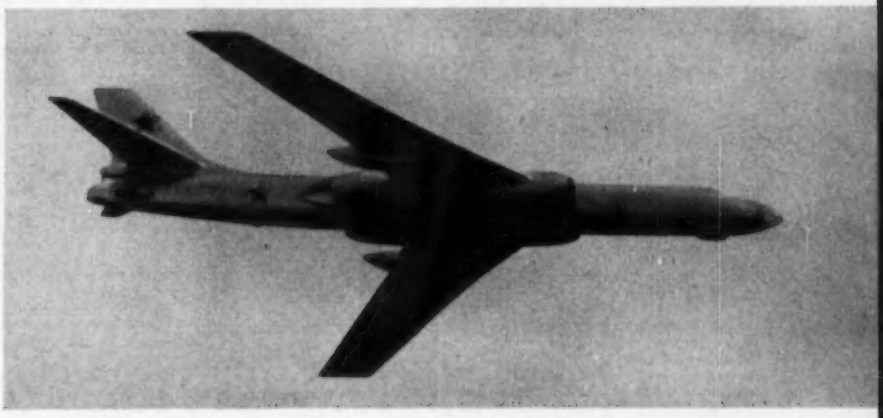
Above, "Blowlamp."



Right, "Bear."

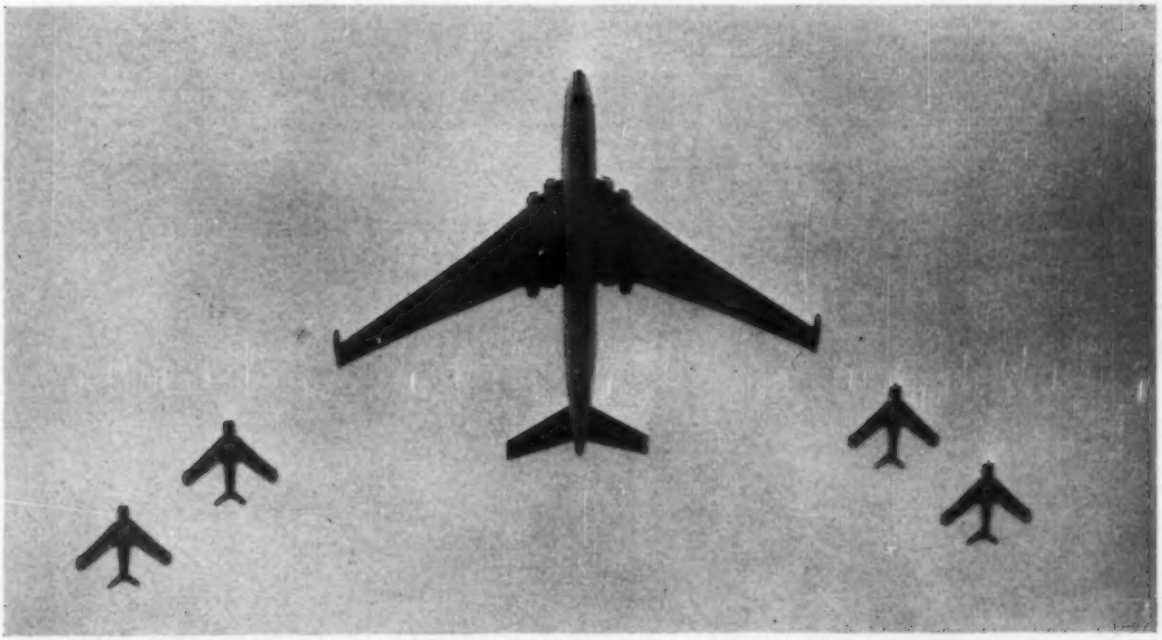
Military Aircraft of the World . . . **SOVIET BOMBERS**

Above, "Backfin."



Right, "Badger."

Below, "Bison" escorted by "Frescoes" (Mig-17).



Military Aircraft of the World . . .

SPAIN

Hispano HA-300 Willi Messerschmitt is reported to be supervising the design of a fighter powered by a Bristol Orpheus engine and having this designation. Very little information has yet been officially released about the project. An early wind-tunnel model suggested a delta-wing plan-form with the single-seat cockpit well forward in the nose, but this has since been considerably modified. Operational use would be for ground-attack and day fighting. No performance figures are available.

Hispano HA-200-R1 Construction of a pre-production batch of these twin-Marboré-powered, tandem-two-seat trainers is proceeding at Seville. The Marboré engines are being made under licence by the Spanish national aircraft engine company, ENMASA. Design work was carried out under the supervision of Messerschmitt and the first flight was made on August 12, 1955. Wings and rear fuselage are those of the earlier, piston-engined HA-100 Triana. The two turbojets are mounted side-by-side in the nose, the jet-pipes issuing beneath the fuselage near the wing trailing-edge. Tip-tanks are permanently attached and provision is made for the carriage of armament for weapon training.

Span, 34ft 2in; length, 29ft 1.5in; height, 10ft 8in; empty weight, 3,697 lb; gross weight, 6,995 lb; max. speed at s.l., 405 m.p.h.; time to 29,000ft, 16 min; service ceiling, 39,360ft; range at 32,800ft, 1,056 miles.

Hispano HA-200-R1 Saeta.

SWEDEN

Saab J35A Draken After a very rapid development programme, the first Drakens should reach Swedish squadrons early next year. The first of three prototypes flew on October 25, 1955; the type was ordered into production in August 1956 and the first production machine flew on February 15 this year. Power is at present supplied by a Rolls-Royce Avon 200 series engine with Rolls-Royce afterburner giving 11,250 lb and 14,500 lb without and with afterburning. On this power the Draken can achieve Mach 1.4 on the level, but the production version has a more powerful Swedish afterburner and will achieve Mach 1.8.

Early aircraft will be fitted for the night fighter rôle, carrying Swedish interception and fire-control radar and an autopilot supplied by Lear. Capabilities will be extended until, in the early 1960s, Drakens will be able to exceed Mach 2 and will have greatly extended armament capability. Either unguided or guided air-to-air rockets, supplementing two 30 mm revolver cannon in the inner wings, are at present specified. Six Bofors 13.5 cm air-to-ground rockets can also be carried under the wings.

An aerodynamic individuality of the Draken is its double delta wing plan-form (aspect ratio 1.77), the low-speed characteristics of which were first assessed with a small-scale piloted prototype, the Saab 210. The inner delta section has a sweep at the leading edge of no less than 80 deg and is, therefore, sufficiently thick to accommodate cannon, a large fuel tank and main undercarriage behind each intake. Outboard, the thin delta section has a sweep of 57 deg. Total wing area is 538.2 sq ft. Saab claim that the Draken layout offers great flexibility for different installations and further development, that it is a relatively small aircraft while offering the operational capability of current larger types and that even with the comparatively small engine at present installed considerable performance can be achieved.

A new technique called extended tooling has been applied to speed production. In this way precision-boring machines are used to prepare parts and five Wharton tool sets, each including 150 standard parts have been brought into use. Skin panels are covered with bonded honeycomb.

The combination of low wing-loading and high lift at low speed allows the Draken to operate from small airfields. With non-skid braking and a tail parachute the Draken can land in 2,000ft and take off in the same distance. Four blunt-edged control surfaces are mounted in the trailing edge of the wing, operated in pairs by hydraulic full-power units and controlled differentially to give both horizontal and lateral control. Q-feel is provided.

Span, 30ft 9in; length, 46ft 6in; gross weight, between 17,900 lb and 20,300 lb; max. speed, Mach 1.4, increasing to Mach 2 plus with final development; min. landing run, 1,500ft; take-off run, under 2,000ft; initial rate of climb, 39,370ft/min.

Saab A32A Lansen.

Saab A32A Lansen Almost all the 12 attack squadrons of the Royal Swedish Air Force are now equipped with the A32 Lansen. It was designed to be able to attack land and sea targets anywhere round the Swedish coasts within an hour of taking off from a central Swedish base. The prototype first flew on November 3, 1952, and exceeded Mach 1 in a dive during the following year. It has a thin, laminar flow wing swept at 35 deg at 25 per cent chord and fitted with boundary layer fences and large Fowler-type flaps. Ailerons and elevator are fully powered by Saab-designed hydraulic units. Pilot and radar operator sit in tandem beneath a single-piece, sideways-opening plastic canopy and have Saab ejection seats. Fixed armament is four 20 mm cannon in the nose, but bombs, rockets and air-to-ground missiles are carried under the wings. Power is provided by a Svenska Flygmotor RM5 (licence-produced Rolls-Royce Avon RA.7 with Swedish reheat). A large radar in the nose serves both navigation and attack.

Span, 42ft 8in; length, 49ft 2in; empty weight, 15,400 lb; gross weight, about 22,000 lb; max. speed, over 700 m.p.h.; landing speed, 125 m.p.h.

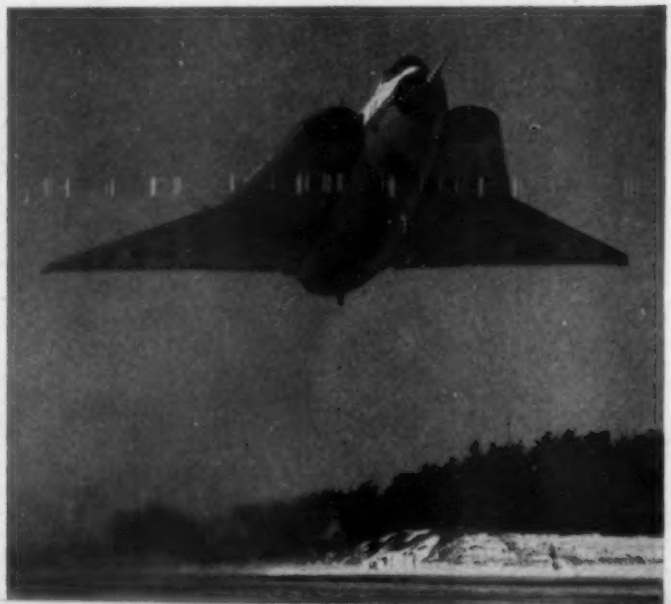
Saab J32B Lansen This version of the Lansen is powered by the more powerful Swedish RM6 engine with enlarged afterburner giving more thrust and therefore much improved climbing performance. New radar and fire-control are installed and the machine is intended primarily as an all-weather fighter. The prototype first flew on January 7, last year. Dimensions are the same as those of the A32A.

Saab S32C Lansen A substantial number of these reconnaissance versions are under construction and will allow Swedish reconnaissance units to convert entirely to jet aircraft. Main differences from the standard A32A are provision for various combinations of cameras in compartments alongside the nosewheel bay, immediately ahead of the intakes. Day and night photography and radar reconnaissance are possible. Dimensions and performance are as for the A32A.

Above, Saab J32B Lansen.

Right, Saab J35A Draken.

Below, Saab S32C Lansen.



Chance Vought F8U-1 Crusader.

U.S.A. FIGHTERS AND FIGHTER/BOMBERS

Chance Vought F8U Crusader Fastest aeroplane in service with any navy, the Crusader is unique among combat machines in having a variable-incidence wing. This allows it to land with the fuselage level, thus permitting the main undercarriage to be very short and giving the pilot an excellent forward view. Power is provided by a Pratt and Whitney J57-P-12 rated at about 16,000 lb with afterburner.

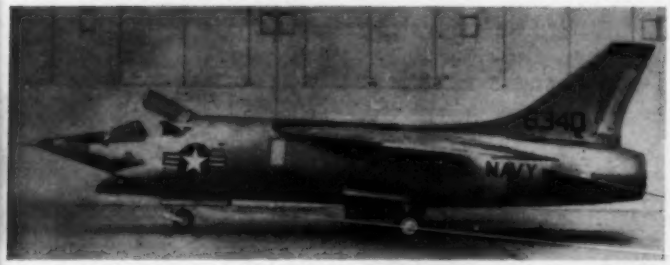
Within the large fuselage are accommodated a radar gunsight, four 20 mm guns, a ventral pack hinged at the rear and accommodating tubes for 32 spin-stabilized rockets, large fuel cells, the powerplant and main undercarriage. Further fuel is accommodated within the wing, which is of about five per cent thickness, forms an integral tank, folds for carrier stowage and has complex hinged leading and trailing edges. A single Sidewinder missile can be carried on pylons on the sides of the fuselage and a refuelling probe is housed to port behind the cockpit.

The F8U-1 day fighter first flew on March 25, 1955. The first production machine flew in September of the same year and squadron deliveries began at the end of 1956. About 300 have so far been built. The F8U-1P is a photographic version in which removal of the guns and ammunition allows for a large flat-bottomed camera bay and a flush refuelling probe. It is capable of night reconnaissance and "special mapping and charting."

The F8U-2 embodies a new fire-control, improved radar and the uprated P-16 engine, and can be distinguished by having ventral tail fins and afterburner air scoops. Deliveries are to begin in September.

Flown for the first time on June 2, the F8U-3 is a completely redesigned aircraft. Powered by a Pratt and Whitney J75, rated at about 23,500 lb thrust with afterburner and fed from a supersonic chin intake, the -3 is described as a "push-button intercepter," placed in the correct mission profile by selecting the appropriate "mode" and feeding this into the flight and fire control system. The guns of earlier Crusaders have been displaced by advanced missiles, such as Sparrow IIIs, and the radar and fire control are extremely advanced. The F8U-3 is intended for speeds of about Mach 2.2 at a height of up to 90,000ft; under these conditions stability is increased by large folding ventral fins. Sperry supply the advanced all-attitude flight control system. The aircraft is designed to have a rocket boost unit, of about 6,000 lb thrust, but this is not fitted to the first machine. A service-test batch of 18 aircraft has been bought, at $9.9m each; these will be evaluated in competition with the McDonnell F4H.

F8U-1: Span, 35ft 8in; length, 54ft 2¾in; height, 15ft 9in; maximum speed, about 1,100 m.p.h.



Chance Vought F8U-3 Crusader.

Convair F-102 Delta Dagger Originally projected in 1951 as a single-seat all-weather intercepter, the F-102 was later substantially modified to give it supersonic performance. The first production F-102A flew in March 1954 and deliveries to U.S.A.F. Air Defense Command started in May 1956. A full description appeared in our issue of April 19, 1957.

Powered by a Pratt and Whitney J57-P-23, rated at about 17,000 lb thrust with afterburner, the F-102 is one of the largest single-seat machines in the world, having a fuselage almost 70ft in length. The foremost 12ft houses the Hughes MG-10 first-control system, which governs the entire interception from the moment of lock-on. Armament comprises six GAR-1, 2, 3 or 4 Falcon missiles (infra-red and radar, mixed) housed in an internal bay and 24 spin-stabilized rockets housed in the weapon-bay doors. Fuel is contained in the fuselage and the integral-tank wings, and external tanks can be fitted for ferrying; no provision is made for inflight refuelling.

Production at San Diego was scheduled at the highest rate of any of the U.S.A.F. "Century series" aircraft, and—despite stretchouts—1,000 had been delivered when the contracts were completed earlier this year. The F-102A equips about 25 Fighter/Intercepter squadrons throughout the U.S.A. Numerous TF-102A side-by-side two-seat versions are also in service, for combat-proficiency training, type-conversion and various tactical rôles. The TF-102 is stubbier and shorter, since the MG-10 system is not carried; the forward fuselage and nose of this version was made at Fort Worth and shipped to San Diego by rail.

Span, 38ft 1½in; length, 68ft 3½in; height, 21ft 2½in; max. speed, about 800 m.p.h.

Convair F-106 Delta Dart Originally designated F-102B, the 106 is a completely redesigned F-102, fitted with new fire-control, armament and powerplant, all housed in an airframe designed for much increased performance. The engine is the Pratt and Whitney J75, rated at about 23,500 lb with afterburner.

Main armament comprises an assortment of GAR-1, 2, 3 or 4 Falcons, MB-1 Genie nuclear-tipped rockets and spin-stabilized rockets. The entire flight is controlled by a Hughes MA-1 guidance and fire-control system, which, via a data-link with the ground, is integrated with the

Convair F-106B Delta Dart.

Military Aircraft of the World . . .

Grumman F9F-8T Cougar.

SAGE system and continental control and reporting network. Special features of the aircraft include variable-geometry supersonic intakes, a WADC Phase II instrument panel (with vertical-scale A.S.I., V.S.I. and altimeter) and no fewer than 18 heavy-press parts (large forgings) in the airframe.

First flight of an F-106 took place on Boxing Day 1956; the aircraft was a single-seat F-106A, which is the current variant built at San Diego. Bulk production began at the end of August last year and about 40 106As have so far come off the line. In addition, Convair's Fort Worth plant are turning out forward fuselages for the tandem-seat F-106B, which—unlike the TF-102A—retains all its armament and fire-control. Convair have made a proposal for a further revised version, powered by a J58 engine and capable of Mach 3.

Span, 38ft 1½in; length, 70ft 8¾in; height, 20ft 3½in; max. speed, about 1,200 m.p.h.

Douglas F4D Skyray This bat-like aeroplane is a carrier-based intercepter, designed and built—like all Douglas naval aircraft—at the company's El Segundo division. Powered by a Pratt and Whitney J57-P-2, rated at 15,000 lb with afterburner, the F4D-1 has outstanding acceleration, climb and altitude performance, but it has been generally overtaken by such machines as the F8U and F11F. Armament comprises an assortment of 20 mm guns and folding-fin rocket packs; no F4D has been publicly seen with missiles, although it is stated that it can use such weapons and has all-weather capability. Its primary rôle is officially regarded as fleet protection, although most of the limited number in service are doing general attack work with the Marine Corps.

Span, 33ft 6in; length, 45ft 5in; height, 13ft; wing area, 557 sq ft; gross weight, 20,000 lb clean; max. speed, about 800 m.p.h.

Grumman F9F Cougar Most important version of this famous carrier-based series is the F9F-8T. Compared with the basic F9F-8 the T model has a nose 34in longer and a second cockpit duplicating the first; only two 20 mm guns are carried but all underwing pylons are retained. The T is used for training in carrier landings, flight refuelling, gunnery and navigation, and can serve as an operational machine. Several thousand single-seat F9Fs are in service as fighter/bombers and photo-aircraft, the last being built in 1957.

Grumman F11F Tiger and Super Tiger The former is a standard fighter/bomber which equips three carrier-based squadrons of the U.S. Navy and is in full production. First aircraft designed to transonic area-rule, the F11F is a remarkably small single-seater, powered by a Wright J65-W-6 or W-18 Sapphire, rated at 7,800 lb dry and 11,000 lb thrust with afterburning.

Unusual features include: four 20 mm guns mounted directly beneath the lateral intakes; single-piece machined wing skins with folding tips; integral fuel tankage within the fin; full-span spoilers for lateral control; and a stumpy undercarriage, with twin nose wheels and main gear folding into the fuselage. Multi-purpose radar is carried and racks are provided for two Sidewinder missiles above the fuselage, and two more under the wings (or a pair of area-ruled tanks). The first F11F flew in August 1954; Grumman announced in April that 146 were then in service and that these had logged over 15,500 operational hours.

The F11F-1F Super Tiger, or Grumman 98J, is a private-venture development which has yet to be ordered. Powered by a General Electric J79-GE-7, rated at 10,500 lb dry or 15,000 lb with afterburner, the Super Tiger has a redesigned airframe to provide improved performance up to Mach 2.1. The guns are deleted in most variants, although Westinghouse Aero-13 fire control is fitted. In April it was agreed that Japan will buy more than 300 of these machines, most of them built in Japan. The prototype has recorded speeds exceeding 1,220 m.p.h. and a height of 76,828ft.

F11F-1 Tiger: Span, 31ft 7in; length, 40ft 10in; height, 12ft 8in; gross weight, less than 20,000 lb; max. speed, about 850 m.p.h.; landing over 50ft on to runway, total distance, 3,100ft.

Lockheed F-104 Starfighter Holder of the world records for absolute speed and altitude, the F-104 is built to a unique configuration, with a stubby razor-edged wing and a T-tail. The 55ft fuselage houses the radar fire-control, the pilot (in a downward-ejecting seat), packaged electronics, a T-171 multi-barrel 20 mm gun, the fuel, and the complete propulsion system consisting of a General Electric J79 turbojet with afterburner associated with variable-geometry intakes and an ejector nozzle.

Five pylons can accommodate a variety of tanks, bombs (including nuclear), gun pods and GAR-8 Sidewinder missiles, and the 104A can serve as a day fighter (the so-called air-superiority rôle), interdictor, photo-reconnaissance aircraft and nuclear bomber. The F-104B carries a navigator behind the pilot and retains all the weapons carried by the single-seater. It is employed chiefly as a conversion and proficiency trainer, with tactical ability. Airfield requirements in both types are minimized by a drooping leading edge and blown flaps. Reductions in

Above, Douglas F4D-1 Skyray.

Convair F-102A Delta Dagger.

TESTING TIME FOR METALS

An Olympus engine in the test cell. A 150-hour type-test at ratings of over 16,000 lb. thrust, now completed for the new Olympus 6, shows this engine to have a greater development potential than any other high-thrust turbo-jet.

Behind the successful development of a modern turbo-jet engine lies a wealth of 'know-how' gained over many years in the laboratory and workshop, test house and aeroplane. There is no substitute for such first-hand knowledge. That is one of the reasons why the 'Nimonic Alloys are pre-eminent in the field of heat-resisting materials. Backed by 17 years of continuous research and operational service, the Nimonic Alloys are making an essential contribution to the reliability and performance of every British gas turbine and are also widely used in ramjets and rockets.

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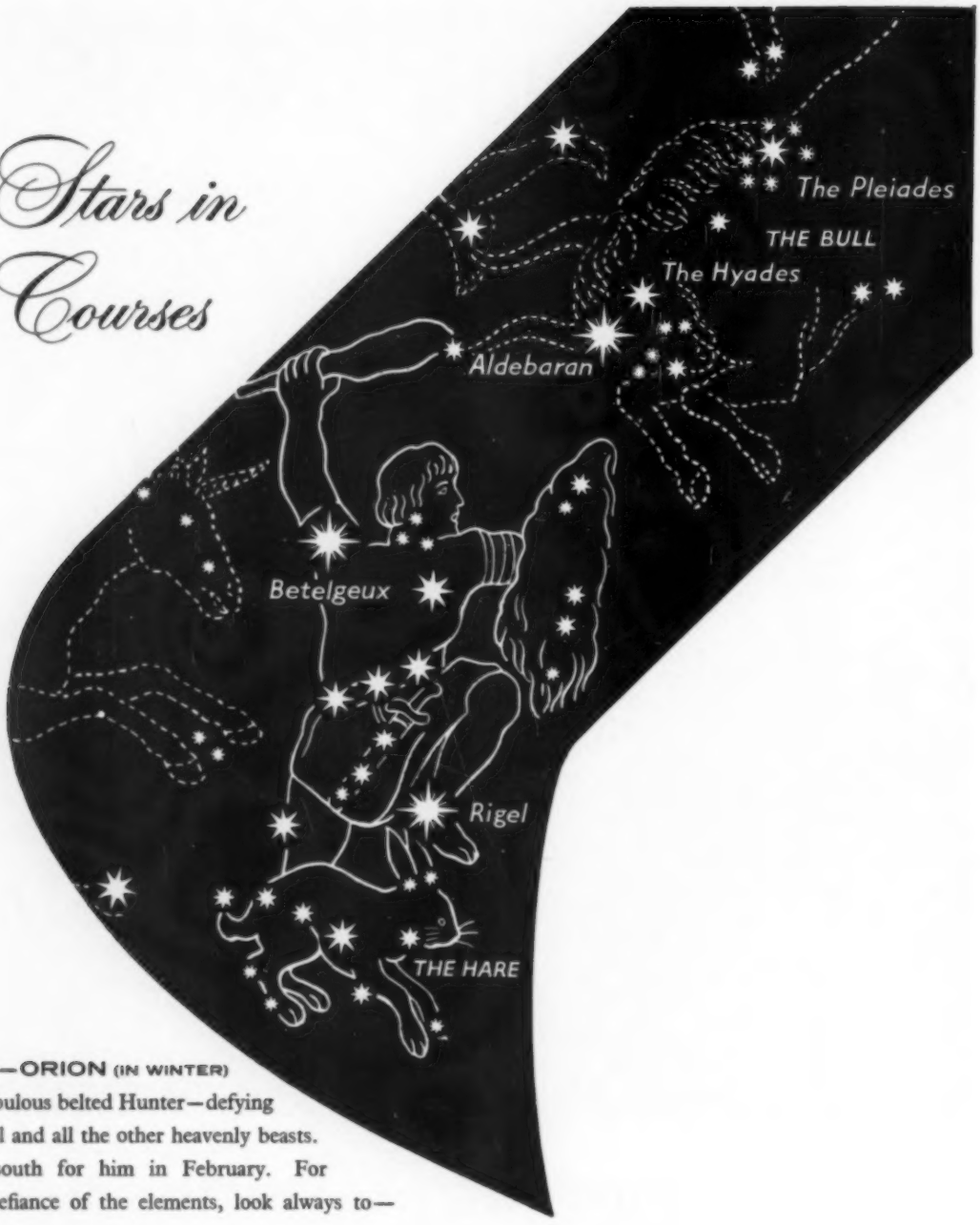
The Stars in their Courses



No. 3—ORION (IN WINTER)
The fabulous belted Hunter—defying the Bull and all the other heavenly beasts. Look south for him in February. For stout defiance of the elements, look always to—

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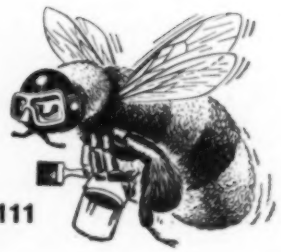

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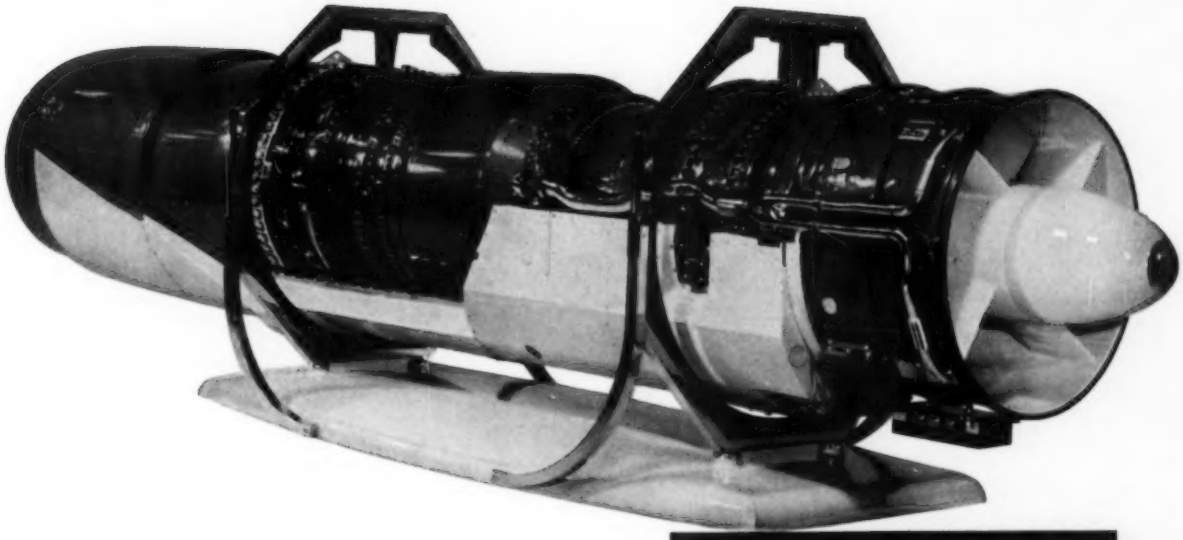
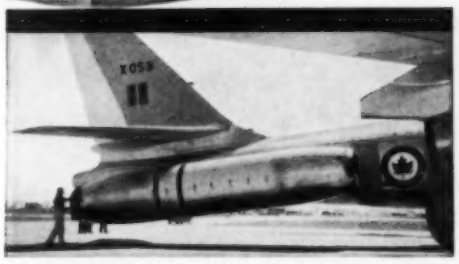


The Iroquois designed, developed and produced by Canadians is the supersonic successor to the Orenda jet engine, 4,000 of which are in service on four continents.



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The supersonic Iroquois is carried in this specially designed pod at the rear of a B-47.

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It is already in quantity production as the Swedish Air Force's new standard combat aircraft.

It has a top speed close to Mach 2 and very impressive climb performances—initial climb rate being some 200 m. (650 ft.) per sec.

It has a greater useful speed range than any other aircraft.

It can operate from smaller and more shrouded airfields than any other supersonic fighter.

It has full radar and navigation equipment for all-weather operations.

It is equipped with the most modern fire-control equipment for collision-course tactics.

It is equally suitable for interception and ground attack purposes. In the interceptor role it carries air-to-air rockets or guided missiles, and heavy-calibre guns. For ground attack use, it carries a heavy load of air-to-ground rockets or bombs.

It is designed for economical production without the use of highly expensive tooling or specialized heavy machinery.

It has been developed by a large industrial enterprise with more than 8.000 employees—including 1.500 engineers—and the most modern technical resources.

It is backed by 10 years of experience in large scale production of high-speed jet fighters.

SAAB-35 "Draken"

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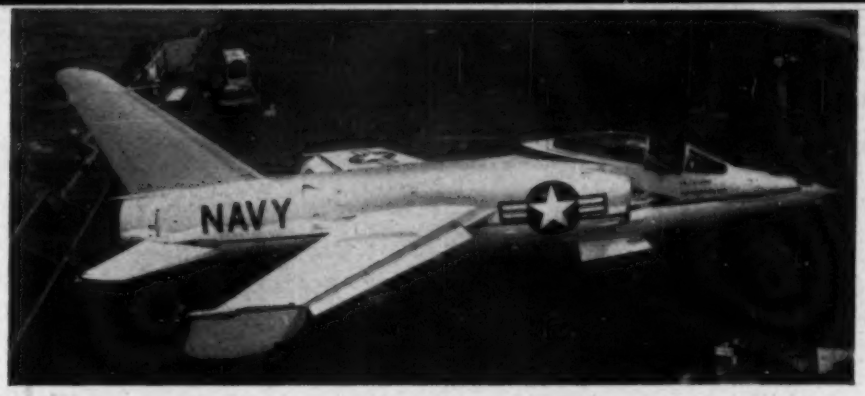
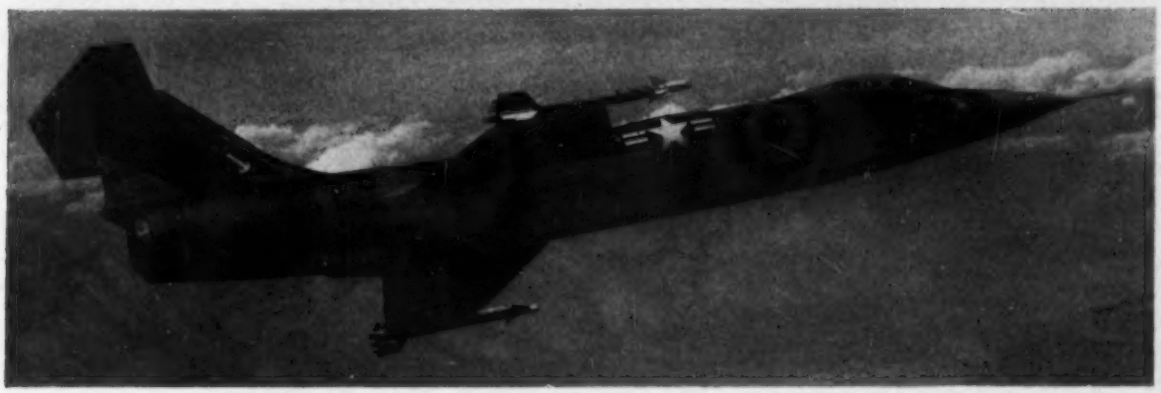
Military Aircraft of the World . . .



Grumman F11F-1 Tiger.

Below, Lockheed F-104A Starfighter.



the total U.S.A.F. Tactical Air Command establishment have limited present production to 294 machines, most of which have been delivered. The type was fully described, with cutaway drawing, in our issue of May 30.

Span, 21ft 11in; length, 54ft 9in; height, 13ft 6in; gross weight, 17,000 lb with full internal fuel or 22,000 with maximum stores load; max. speed, about 1,500 m.p.h.; ceiling, has reached over 91,000ft.

McDonnell F-101 Voodoo The F-101 is one of the largest, and certainly the most powerful, of all fighters in service. The basic version, the F-101A single-seater, first flew in September 1954 and entered service in May 1957. Originally planned as an escort machine for S.A.C. it is actually serving as a multi-purpose aircraft with Tactical Air Command. Powered by two Pratt and Whitney J57s, rated at 14,500 lb each with short afterburners, it has four 20 mm guns, and a rotary bomb door on which can be mounted three GAR-1/4 Falcon missiles or other stores. One of these machines set a world speed record of 1,207 m.p.h. last year.

The latest variant in production is the largely redesigned F-101B all-weather intercepter, which has more powerful engines, carries a navigator behind the pilot and makes provision for various weapon loads including a pair of MB-1 Genie nuclear-tipped rockets. The B flew in March 1957 and is now coming into service with Air Defense Command. Overall 101B production has been stretched out and cut slightly, the total order being $355,795,849.

Span, 39ft 8in; length, 67ft 5in; height, 18ft; max. speed, over 1,200 m.p.h.

McDonnell F3H Demon This big carrier-based fighter had a chequered early history, but the -2, -2M and -2N versions at present in service are extremely popular with both Atlantic and Pacific Fleets. Its chief claim to fame is its internal fuel capacity of 1,254 Imp. gal; this, allied with four 20 mm guns and an assortment of bombs, rockets, Sparrow III missiles, Sidewinders, Bullpups or tanks up to a total load of some 33,900 lb, is a remarkable load for one man and a single Allison J71-A-2 engine, of but 13,000 lb thrust with afterburning. Moreover the F3H-2N is also endowed with full night and all-weather radar. It is about to give way in production to the F4H.

Span, 35ft 4in; length, 58ft 11in; height, 14ft 7in; wing area, 519 sq ft; empty weight, 22,133 lb; gross weight, up to 33,900 lb; max. speed, about 740 m.p.h.

McDonnell F4H Powered by two General Electric J79 turbojets, each rated at some 16,000 lb with afterburner, the F4H has an internal fuel capacity of more than 1,500 Imp. gal, giving it "the greatest range of any Navy jet fighter." Pilot and navigator sit in tandem behind the all-weather fire control which governs the primary armament of four Sparrow III air-to-air missiles carried half-submerged on the underside of the fat fuselage. Owing to the wide undercarriage track the F4H can also carry a Hound Dog countermeasures or hydrogen-warhead missile. Unusual features include 25-deg anhedral on the tailplane and acute dihedral on the outer panels of the wings (these components are made by Northrop). Service tests will take place with the 23 F4H-1s purchased (at $7,405,000 each) in competition with the F8U-3.

Span, 38ft 5in; length, 56ft excluding test probe; gross weight, over 40,000 lb; design speed, Mach 2.

North American F-86 Sabre Many thousands of these stalwart machines remain in service, chiefly in the following versions:—

F-86D: two thousand are in U.S.A.F. Air Defense Command, powered by the J47-GE-17B or -33 of 7,650 lb afterburning thrust. They are being taken in batches of about 90 and extensively modified and "integrated into the Continental control and warning system."

F-86H: this is a strengthened fighter/bomber operating with Tactical Air Command; it is powered by a J73-GE-3 of 9,300 lb thrust.

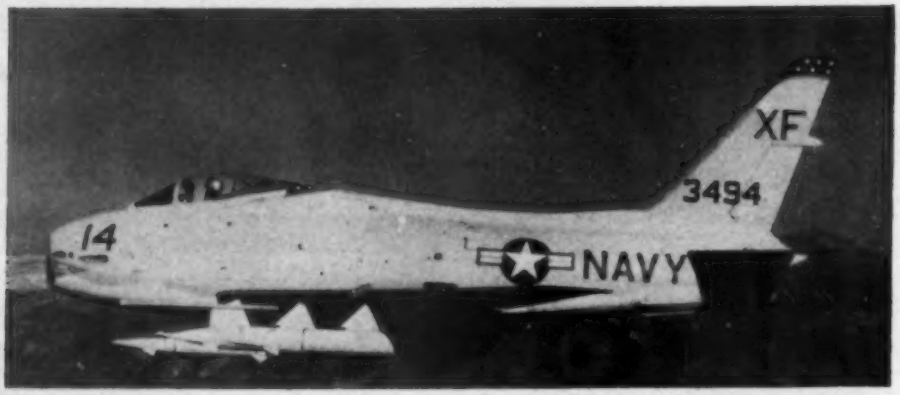
F-86K: an all-weather fighter, powered by an afterburning J47, the K differs from the D in having a longer fuselage housing MG-4 fire control and four 20 mm guns in lieu of rockets. The K is in production by Fiat in Italy for many NATO countries.

F-86L: several hundreds of these all-weather gun-armed machines —essentially similar to the K—have been prepared for shipment from Los Angeles to NATO air forces. Most are converted F-86Ds.

McDonnell F3H-2M Demon.

Below, McDonnell F-101A Voodoo.

Military Aircraft of the World . . .



North American FJ-4B Fury. Below, McDonnell F4H-1.

North American F-100 Super Sabre Originally designed as the first supersonic combat aircraft for the U.S.A.F., and a direct replacement for the versatile F-86 Sabre, the YF-100 flew in May 1953. The F-100A was in full production three months later and several hundred were delivered between then and the end of 1954. Powered by a Pratt and Whitney J57-P-7, rated at 14,500 lb with afterburner, the F-100A has an armament of four M-39 20 mm guns and is employed as a day fighter.

During 1955 and 1956 production centred upon the F-100C, with the uprated P-21 engine and six underwing racks for various stores. Other improvements in this model include a probe for flight refuelling the internal tanks and a later electronic system for bombing and other functions. The C was built at a rapid rate at both Los Angeles and Columbus, and perhaps a thousand are now in service with the U.S.A.F. in America, Alaska, Germany, North Africa, Japan, Spain, Saudi Arabia and elsewhere. It can be zero-length launched, with a single large booster.

It was succeeded by the F-100D, which, although retaining the four M-39s, makes provision for a Minneapolis-Honeywell MB-3 autopilot and auto-fire-control system, thus relieving the pilot of responsibility except that of basic monitoring of the mission. The D model has wing flaps, the earlier versions having inboard ailerons and no flaps. Another improvement in the D is flight refuelling for internal and external tanks. This version also was made at Columbus.

The only version now in production, and that only at Los Angeles, is the tandem-seat F-100F. Three feet longer than the single-seaters, the F has the same fuel and stores capacity, but carries only two guns. It is used as a trainer, fighter and attack machine. Like all F-100s in service it can be equipped as a tanker for Buddy refuelling, as shown in the illustration.

F-100F: Span, 39ft; length, 50ft 6in; height, 16ft; gross weight, about 33,000 lb; max. speed, about 850 m.p.h.; range with full stores load, over 1,000 miles

North American FJ Fury series The only versions of this Sabre-derivative in first-line service are those based on the FJ-3 and FJ-4, both of which are powered by the Wright J65 Sapphire. All FJs were designed and built at Columbus.

Compared with earlier versions the FJ-4 has a new airframe, incorporating techniques developed for the F-100, and it includes inboard aileron/flaps, a slab tail, a single-surface split rudder and provision for flight refuelling. The FJ-4B has multiple speed brakes, increased weapon versatility (including six stores, six Sidewinders and four 20 mm guns), a stronger airframe and a new three-axis control for low-altitude operations and toss-bombing nuclear weapons. This version has a Wright J65-W-16A of 7,800 lb thrust. Tests are now in hand on the FJ-4F, boosted by a Rocketdyne AR-1 rocket motor (H.T.P./kerosine).

FJ-4B: Span, 39ft 1in; length, 36ft 4in; height, 13ft 10in; gross weight, over 26,000 lb; max. speed, over 600 kt; service ceiling, over 45,000ft.

Northrop F-89 Scorpion Almost one thousand of these big all-weather fighters have been delivered to the U.S.A.F., the last being completed at the end of 1957. Powered by two Allison J35 turbojets, rated at 7,500 lb each with afterburner, the current models differ chiefly in armament. They are: F-89C, early radar and six 20 mm guns; F-89D, Hughes fire-control, 104 folding-fin rockets; F-89H, six GAR-1/4 Falcon missiles and 42 rockets; F-89J, Hughes MG-12 system, 42 rockets, six GAR-1/4 and two MB-1 Genie nuclear rockets. The J model is being produced by converting earlier types. The F-89 has the lowest accident rate of any modern jet fighter known to the U.S.A.F.: 23 major incidents per 100,000 hr.

Span, 59ft 8in over tip nacelles; length, 53ft 10in; gross weight, 46,000 lb; max. speed, 600 m.p.h.

Northrop N-156F This private-venture project is a simple supersonic long-range fighter derived from the T-38 trainer. Similarly powered by two J83 or J85 turbojets, giving an aggregate afterburning thrust of about 6,000 lb, the N-156F will be a single-seat aircraft with the following special features: blown flaps; air-load-operated slats; braking parachute; Teflon-surfaced skids supplementing the oversize tyres for operation from unprepared strips; and provision for rocket-boosted zero-length launching. Northrop are energetically promoting the aircraft, particularly to NATO and SEATO nations as an economical means of obtaining flexible Mach 2 performance.

Span, 26ft 5in with wing-tip missiles; length, 41ft 7½in; height, 13ft; gross weight, 11,500 lb; max. speed, designed for speeds in excess of Mach 2 (1,320 m.p.h.); max. range, 1,700 n.m. with external tanks.

Republic F-84F Thunderstreak Powered by a Wright J65 Sapphire of some 7,200 lb thrust, the F-84F is widely used by the U.S.A.F. and many NATO air forces as a fighter/bomber with nuclear capability. It can be air refuelled, has an internal armament of six 0.50in guns and can carry 6,000 lb of stores.

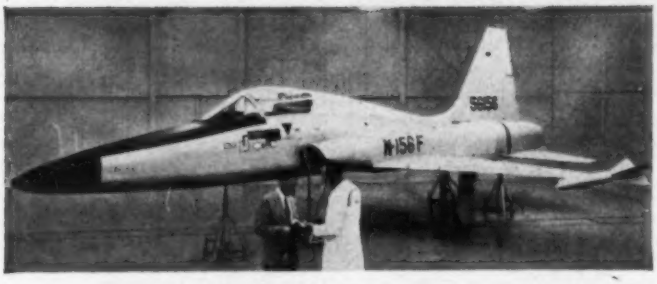
Span, 33ft 6in; length, 43ft 4in; gross weight, 25,000 lb; max. speed, over 650 m.p.h.

Republic F-105 Thunderchief Described by Gen. Otto P. Weyland, commander of the U.S.A.F. Tactical Air Command, as "the most powerful one-man airplane in the world," the F-105 is being produced in

"Buddy" refuelling by two North American F-100D Super Sabres.

Republic F-105B Thunderchief.

Below, Northrop N-156F.



several versions to serve a variety of functions. All are powered by a single Pratt and Whitney J75 turbojet, rated at about 23,500 lb maximum thrust with afterburner.

The aircraft was originally planned in 1952 as a successor to the F-84F fighter/bomber, and the first YF-105A flew on October 22, 1955. Since then the design has been completely altered to improve all aspects of performance. The basic aeroplane follows traditional Republic lines but is characterized by such features as great size (for a single-seater), an internal weapons bay, spoilers, aft petal speed brakes and unique supersonic engine intakes with swallowed oblique shocks controlled by hydraulically actuated wedges.

Like all American combat aircraft the 105 was planned from the outset as a weapon system; the system is WS-300A, for which another aircraft, the unsuccessful F-107, was also tendered. The basic version, and the only variant so far released for service, is the F-105B, a single-seat day fighter/bomber. This is intended "to deliver nuclear weapons and heavier loads of conventional bombs and rockets at extremely high speeds over long ranges." Standard equipment includes a flight-refuelling probe and a T-171 multi-barrel 20 mm gun fed by a two-belt system at 6,000 rds/min. Fire control is governed by a General Electric (LMEED) MA-8 system, which includes radars, an automatic lead-computing sight, a toss-bombing computer and what are described as "other portions to handle all methods of attack." Eclipse-Pioneer supply a central air-data computer and three vertical-scale flight instruments (A.S.I., V.S.I. and altimeter) in the WADC Phase II panel. Powerplant is the J75-P-3, but the P-5 engine will be retro-fitted when available.

Later variants include the 105C tandem trainer, the 105D single-seat day fighter/bomber with extra radar and the 105E two-seat all-weather fighter/bomber and mission-profile trainer, all powered by the uprated P-10 engine and the A.W. version having a monopulse radar by N.A.A. Autonetics. The JF-105B is a systems test vehicle "reflecting the change from the original photo-reconnaissance to other reconnaissance methods." Total production orders stand at $347m, representing about 180 aircraft. Approximately 600 were to have been ordered—all for the U.S.A.F. Tactical Air Command—but the programme is at present being stretched out to a lower production rate. It is possible that the 105 may be supplied to NATO air forces; it may even be built in Europe, perhaps with a European engine.

F-105B: Span, 34ft 11in; length, 63ft 1in; height, 19ft 8in; gross weight, over 30,000 lb; max. speed, about 1,400 m.p.h.

BOMBERS AND STRIKE

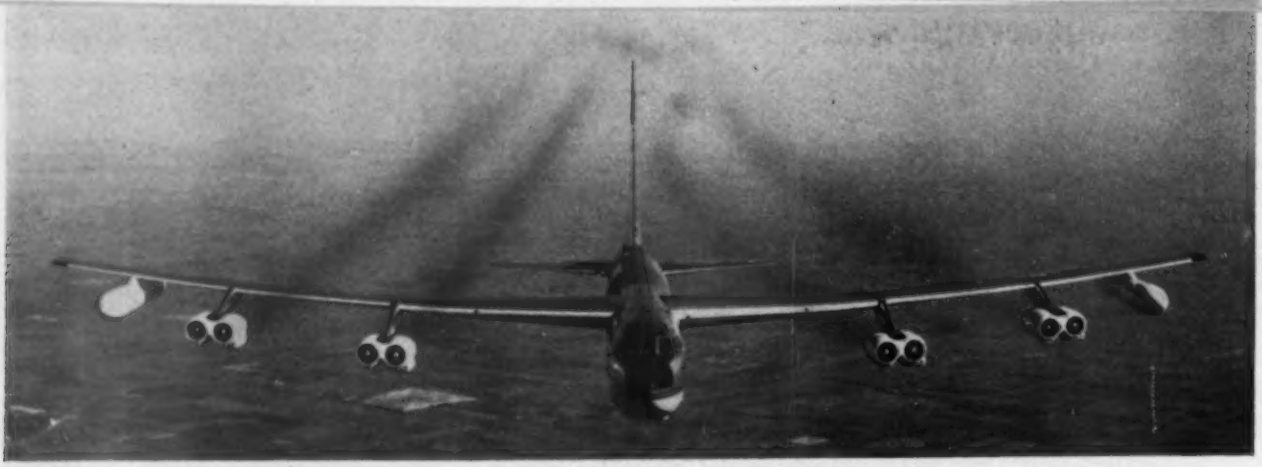
Boeing B-47 Stratojet Some 1,500 of these familiar six-jet aircraft are serving with the U.S.A.F., the majority with medium bomb wings of S.A.C. Chief versions are the B-47E, RB-47E reconnaissance aircraft, ETB-47E multi-purpose trainer and radar aircraft, B-47K photo and weather reconnaissance aircraft and the DB-47E equipped to launch a GAM-63 Rascal missile (picture, page 852). Most of the 47s have now become, in the words of a U.S.A.F. general, "somewhat tired" from their arduous flying for several years. About 1,400 are being strengthened by their original builders (Boeing Wichita, Lockheed Marietta and Douglas Tulsa) to fit them for further years of such duties as low-altitude missions and toss bombing.

Boeing B-52 Stratofortress As the spearhead of the U.S.A.F. Strategic Air Command, the B-52 is an aeroplane of the first importance. It is the only truly competitive delivery system capable of penetrating to any part of any country from a U.S.A.F. base. Its production has involved firms in every one of the 48 states and has so far absorbed some $5,000,000,000, to which must be added about half as much again for airfields and supporting services.

The basic vehicle was described, with a cutaway drawing, in our issue of November 15 last. On the enormous wing are hung four nacelles each housing a pair of Pratt and Whitney J57 turbojets of some 13,000 lb (wet) thrust each. In most aircraft now in S.A.C. squadrons fuel is housed in cells along the wing and top of the fuselage and in large underwing tanks, to a total of 29,000 to 32,000 Imp. gal. The crew of six comprise two pilots, navigator, bomb-aimer and countermeasures operator grouped in the two-deck pressurized nose, and a gunner in a pressurized tail compartment fitted with four 0.50in guns (two 20 mm in early B-52s) controlled by an advanced monopulse radar and optical system. The bomb bay, which lies between the fore and aft steerable trucks of the landing gear, can accommodate any U.S.A.F. store; and, for reconnaissance missions, the bay doors can be removed and a special capsule inserted containing a battery of cameras and two operators.

The YB-52 flew in April 1952. First delivery from Seattle took place in 1955, and second-source output from Wichita started at the end of that year. Some 350 have now been built, the current rate of 15 per month being lower than originally programmed and stretching out production to enable a greater proportion of the total order to be of improved versions.

Major versions include the B-52C (weight rise to 450,000 lb, built at Seattle, convertible bomber/reconnaissance), the B-52D (bomber only, Wichita and Seattle), the E (improved systems), the F (new systems, Sundstrand-driven alternators instead of distributed bleed-air power, more powerful engines) and, about to fly, the G. The B-52G is the most advanced sub-type, and it differs in having a "wet" integral-tank wing, a



Above, Boeing B-52F Stratofortress.

Military Aircraft of the World . . .

Right, Convair B-58 Hustler.

remotely controlled tail barbette, "simplified" systems, revised structure and control surfaces, a squat 40ft fin and ability to carry one or two GAM-77 Hound Dog missiles under the wings. Early next year Seattle will cease to make B-52s, leaving Wichita to build the G model. Excluding the 39 extra aircraft voted for in May, there will be 11 wings of 45 aircraft each, plus 108 for attrition—a total of 603. The last G model should be delivered in November next year.

B-52F: Span, 185ft; length, 156ft 6in; height, 48ft 3½in; wing area, 4,000 sq ft; empty weight, about 180,000 lb; gross weight, 450,000 lb; max. speed, about 670 m.p.h.; range with full bomb load, about 7,000 miles.

Convair B-58 Hustler This very successful aeroplane forms the vehicle portion of Weapon System 102, responsibility for the entire system being vested in Convair's Fort Worth division. The basic aircraft has a 60-deg delta wing and a swept fin, the controls being irreversibly powered elevons and a rudder. On the wing are hung four G.E. J79 turbojets, each rated at about 16,000 lb thrust with afterburner and cowled in oval-section nacelles provided with variable-geometry intakes and advanced cooling systems. The fuselage houses the pilot, navigator/bombardier and defence-systems operator one behind the other. Under it is space for a pod of formidable dimensions, the contents of which can be chosen to suit the requirements of the mission.

Pod contents include: a thermonuclear device, falling ballistically; warhead plus propulsion; cruise fuel as well as a warhead; countermeasures; infra-red and optical surveillance and recording gear; and defensive equipment. The basic aircraft also has built-in defence, in the form of a T-171 multi-barrel 20 mm gun in a turret reminiscent of the sting of a wasp (picture, page 852). Airframe construction includes large areas of brazed stainless-steel honeycomb, magnesium-thorium and reinforced plastics.

Some of the more important of the 20,000 subcontractors to Convair include Sperry (complete navigation and guidance system), Sylvania (complete electronic countermeasures system), Hamilton Standard (air conditioning, fuel controls and starters), Raytheon (radars), Fairchild Camera and Instrument (photo systems), Melpar (recce systems), Advance Industries (indirect bomb-damage assessment system), Magnavox (communications), Bendix (civil navigation aids), Emerson (active defence system, i.e., control of gun and missiles), Westinghouse (power electrics) and Eclipse-Pioneer (autopilot and flight control system). About 41 per cent of the total cost of each B-58 is accounted for by electronics. Even the photo-reconnaissance pod includes a TV camera and optical system to control the cameras, which are all of new designs including a 9 × 18 long-focus design and a 2½ × 2½ fast-cycling unit.

The first of 13 development aircraft flew on November 11, 1956. At least twelve B-58s have flown, and Phase IV testing is now almost complete—an unparalleled rapidity of flight development, notwithstanding the vastness of the task. The 6592nd Test Squadron of ARDC is now conducting Phases V and VI, so that the first operational unit should be capable of formation this year. Phase IV naturally included such items as pod dropping, reconnaissance evaluation and refuelling from KC-135s. Fiscal year 1958 paid for 17 B-58As and 1959 allowed for 47, making a total of 77. The batch of 47 will equip one complete S.A.C. wing—replacing B-47s—at a weapon-system cost of about $760m. Many more B-58s may be bought in fiscal year 1960, which has now begun.

Span, 57ft; length, 97ft 6in; height, 30ft 11in; gross weight, 160,000 lb with pod; max. speed, about 1,500 m.p.h.

Douglas AD Skyraider This incredibly versatile aeroplane was in production from 1947 until 1957 and 3,180 were built. Current versions, powered by the 2,700 h.p. Wright R-3350-26W, serve the rôles of multi-purpose attack, all forms of reconnaissance, transport, evacuation, early warning radar picket, target towing, anti-submarine and "special operations."

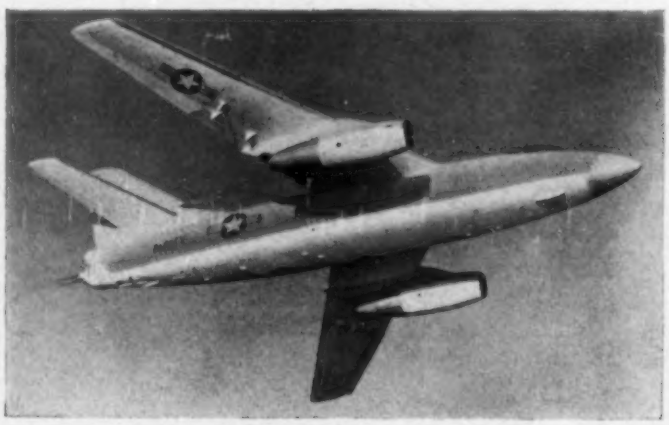
Span, 50ft 9in; length, 39ft; height, 15ft 8in; empty weight, 10,500 to 12,000 lb; gross weight, 18,000 to 25,000 lb; max. speed, up to 365 m.p.h.

Douglas A3D Skywarrior First flown in October 1952, the A3D is both the largest and heaviest aeroplane yet designed for carrier operations. Powered by two Pratt and Whitney J57 engines, it carries a crew comprising pilot, navigator/turret operator and bombardier in a forward compartment, ahead of which is the radar bombing gear and behind are the bomb bay, tank bays and twin 20 mm tail guns. Wings and vertical tail fold for carrier stowage. Both the A3D-1 and A3D-2 (improved engines and other details) are in service on several *Forrestal*-class carriers. Other types of A3D are dealt with on other pages.

Span, 72ft 6in; length, 74ft 5in; height, 22ft 9in; wing area, 730 sq ft; empty weight, 39,760 lb; gross weight, 73,000 lb; max. speed, over 600 m.p.h.; range with full stores, over 2,000 miles.

Douglas A4D Skyhawk Intended as the smallest and most efficient carrier-based jet attack aeroplane, the A4D has a cropped-delta wing so small that it need not fold. The entire wing forms an integral tank from tip to tip—as shown in our full description of the aircraft on March 7 last—and the fuselage houses the specially tailored electronics, the pilot in a lightweight seat, the Wright J65-W-4 engine, rated at 7,800 lb thrust, and additional tankage. Armament includes two 20 mm guns, and the three pylons can carry up to 5,000 lb (1,000 on each wing and

Douglas A3D-2 Skywarrior.



The Blackburn NA.39 Strike Aircraft

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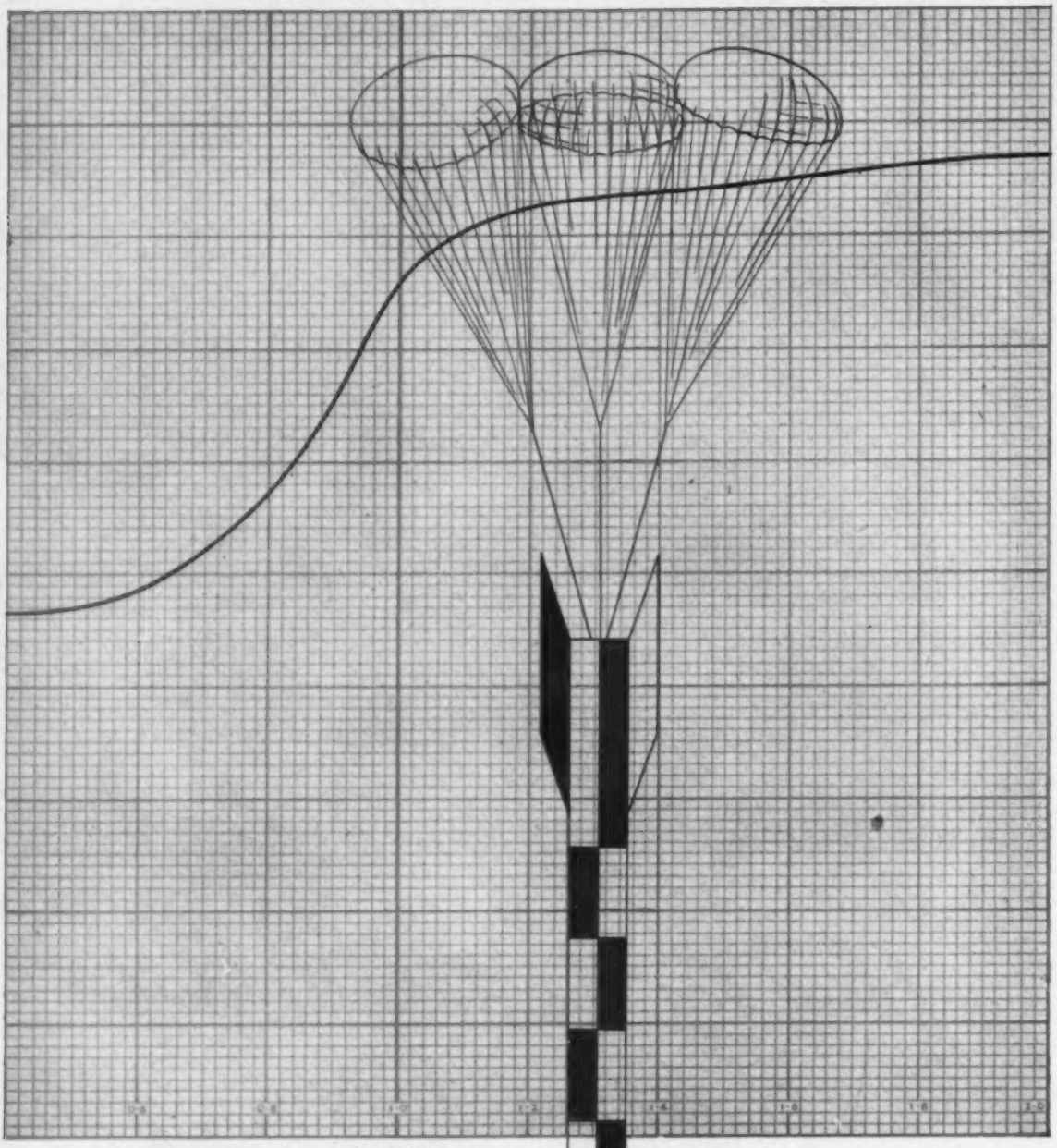

Variation of Drag Area with Mach No.
Performance curve for G.Q. Supersonic Parachute.

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Military Aircraft of the World . . .

Right, North American A3J-1 Vigilante.

Below, Douglas A4D-1 Skyhawk.

3,000 on the centreline). Typical stores include the Buddy refuelling pack, a nuclear weapon, the Bullpup missile or the Mk 11 gun package (picture, p. 851).

Deliveries began in October 1956, and more than 13 squadrons of the U.S.N. and U.S.M.C. now use the A4D from shore bases and carriers. The current version is the A4D-2 with several improvements. Production is currently at the rate of five per week, but should tail off this year.

Span, 27ft 6in; length, 39ft 1in (41ft 11in with refuelling probe extended); height, 15ft 2in; wing area, 260 sq ft; gross weight (-2, using JP-4), 15,500 lb; max. speed, clean, 587 kt; max. range, 1,000 n.m. using the 641 Imp. gal internal fuel.

Douglas B-66 Destroyer Originally derived from the Navy's A3D, the B-66 is actually a completely different aircraft. Several versions are in service with many branches of the U.S.A.F. All are powered by two Allison J71-A-13s rated at 10,200 lb for take-off. General Electric supply the paralleled A.C. electrics and twin 20 mm tail turret fire control.

The service-test RB-66A model flew in June 1954. Deliveries of the B-66B three-seat high- and low-level bomber began to flow from Long Beach in March 1956. Long Beach has also built the RB-66B night and photo-reconnaissance machine. From Tulsa have come the RB-66C for all-weather electronic reconnaissance and 55 WB-66Ds. The latter carries, in addition to the pilot, navigator and gunner, two weather equipment operators who monitor extensive instrumentation and computers from which complete weather reports and forecasts can be obtained. Total production was 209 aircraft, the last being delivered this month.

Span, 72ft 6in; length, 75ft 2in or 77ft; height, 23ft 7in; wing area, 780 sq ft; weight empty, 40,330 to 43,476 lb; gross weight, up to 83,000 lb; usual internal fuel, 3,738 Imp. gal; max. speed, 640 m.p.h.; range, 1,500/1,750 miles.

Grumman A2F Intended as a replacement for the Douglas AD and A4D, the A2F design won a U.S. Navy competition in January. It will be a versatile carrier-based attack machine, powered by the Pratt and Whitney J52 turbojet of about 8,000 lb thrust, and intended for operations at both high and low altitudes. Pilot and navigator will sit in tandem, full all-weather radar will be installed and provision will be made for carrying various missiles such as Bullpup, Corvus and Hound Dog.

Martin B-57B About 400 of these developments of the English Electric Canberra are in service with the U.S.A.F., chiefly in Tactical Air Command, Germany and Japan. Powered by two Wright J65-W-5 turbojets, each of 7,220 lb thrust, the B-57B seats pilot and navigator in tandem. Weapons are carried under the wings and internally on a rotary bomb door. Wing-mounted guns are optional, either four 20 mm or eight 0.50in being specified.

Span, 64ft; length, 65ft 5in; gross weight, 55,000 lb; max. speed, over 600 m.p.h.

North American A3J Vigilante Described in some detail in our issue of May 30, the A3J has been designed and built at N.A.A.'s Columbus division, which unveiled the first in May. It is a Mach 2 carrier-based "delivery system" for all forms of attack, as well as radar, photo-optical and infra-red reconnaissance, and other types of mission. Power is provided by twin G.E. J79s with afterburners.

Pilot and navigator sit in tandem. Behind them are fuel tanks, the supersonic intakes and ducting and a large weapons bay from which stores are ejected through an aft-facing tube. The navigation and guidance system is an inertial or stellar-inertial system developed by N.A.A.'s Autonetics division and presumably using a star tracker of the N2 family. According to *Aviation Week*, the radar bombing system will be the ASB-11 or -12, comprising a Convair K-band radar, an Eastman Kodak optical sight and a computer by Autonetics. Features of the airframe noted in our previous article include a nitrogen system for actuation of the undercarriage, blown flaps and speed brake, and flight control by spoilers (instead of ailerons) and "slab" vertical and horizontal tail surfaces.

In service the A3J should be versatile. Virtually every naval store can be carried in the bomb bay and on two wing pylons, and in spite of the flashing performance the aircraft is capable of safe carrier operation and of being struck down below, with folding nose radome, outer wings and vertical tail. The A3J-1 is not, however, intended for full-E.A.S. operation at low altitude. The A3J-2, or a subsequent version, may have a rocket motor between the jet-pipes. Fleet service is scheduled for 1960-61 and a land-based derivative may be bought by the U.S.A.F.

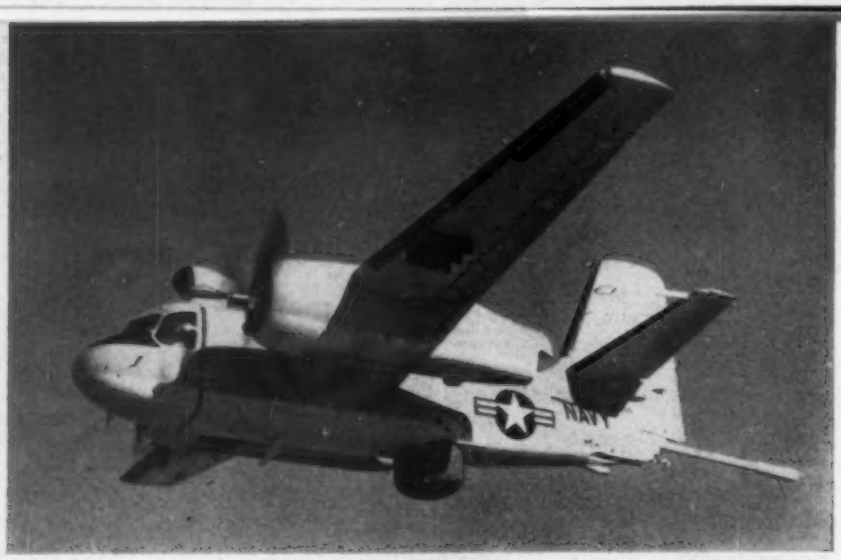
Span, 50ft; length, 70ft; height, 20ft; gross weight, 49,500 lb; max. speed, about 1,200 m.p.h.; ceiling, expected to be more than 90,000ft; range with full load, about 2,000 n.m.

North American B-70A Undoubtedly this aeroplane is the most advanced winged vehicle being actively developed outside the Soviet Union, and the prime contractor is marshalling his great resources accordingly. Bearing the Weapon System number of 110A, the project is also dubbed CPB, for chemically-propelled bomber.

North American won the mighty contract in competition with Boeing, who reportedly submitted a slower and more conventional design. The B-70 is described as "a Buck Rogers bomber cruising at twice the speed of an artillery shell . . . she'll do 33 miles a minute. . . ." Design figures are actually roughly similar to those of the defunct Navaho missile: Mach 3.25 at over 70,000ft and a range of 6,000 miles with eventual extension to 9,000. According to a spokesman of S.A.C. "the B-70 is over the hump where the faster you go the more miles you get per gallon." The key to the design is that it is "optimized" for all-supersonic flight; originally the WS-110A requirement postulated

Douglas RB-66B Destroyer.

Military Aircraft of the World . . .



Grumman S2F-1 Tracker.

subsonic cruise. The ability to achieve Mach 3 for up to three hours is one of the greatest technical achievements in all aviation.

The basic vehicle will have six General Electric J93 turbojets of some 30,000 lb thrust each, burning hydrocarbon fuel ahead of the turbines and—probably—alkylated borane fuel in the afterburners. The airframe will be largely made of brazed stainless-steel honeycomb, and the crew—probably numbering three—will occupy a detachable capsule. The basic guidance system is the stellar/inertial AN/ASQ-28, for which the prime contractor is I.B.M. Under subcontract to this firm the Autonetics division of North American will produce the N2J star tracking unit. G.E. are working on a defence-system programme to surmount such hurdles as the noise level of 190 db outside the B-70 and 160 db inside, the 4,000 deg R temperature of the jets and the fact that, with high-energy fuel, the contrail could become opaque to the surveillance radar.

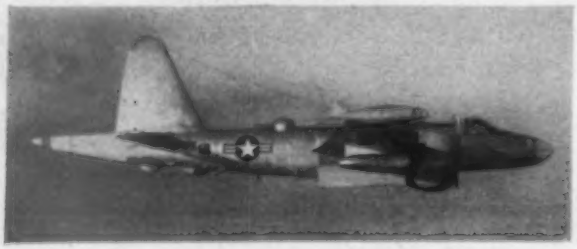
The following are some recent references to the aircraft. Mr. "Dutch" Kindelberger, chairman of the board of North American: "The human crew provides unique advantages . . . these include target location and identification, flexibility to choose alternate targets . . . ability to counter defensive measures . . . and the capability of recall." Mr. Kindelberger noted that the B-70 will be able to launch a ballistic missile.

Gen. Thomas D. White, U.S.A.F. Chief of Staff: "The project is vital to us . . . we hope to cut the normal development cycle by 18 months . . . and have considered setting up a special organization similar to the Ballistic Missiles Division. Maj-Gen. James Ferguson, director of requirements, DCOS (Development): "Its sophisticated systems will enable the crew to ferret out small targets of uncertain location which are critical elements of military strength. It will have both high- and low-level penetration capability."

The B-70A is scheduled to fly in 1962 or late 1961, and to enter S.A.C. service in 1963.

Lockheed ASW Electra (model).

Grumman AO-1 Mohawk (mock-up); below, Lockheed P2V-7 Neptune.



ANTI-SUBMARINE

Grumman S2F Tracker First flown in December 1952 and now operating from many carriers and shore bases, the S2F Tracker is a search and strike anti-submarine aircraft, powered by two 1,525 h.p. Wright R-1820-82 engines. Carrying a crew of four, the Tracker can search with radar (in a dorsal pod and a retractable "dustbin"), a searchlight (starboard wing), magnetic detector gear (retractable tail boom) or sonobuoys (ejected from behind the engine nacelles); it can then strike with bombs, mines, torpedoes, depth charges or underwing rockets. One hundred S2F-1s are being built by D.H. Canada for the R.C.N.; the S2F-2 has a wider bomb bay to house a new weapon (probably the Betty nuclear depth charge); the S2F-3 is a later version now under development. About 640 S2F-1s and -2s have been built.

Span, 69ft 8in; length, 42ft 3in; height, 16ft 3½in; wing area, 485 sq ft; gross weight, 24,000 to 26,000 lb; max. speed, about 300 m.p.h.

Lockheed P2V Neptune Since 1944 the U.S. Navy have placed 26 separate orders for this patrol and anti-submarine aeroplane, which is also used by several other countries. Most of those in service are P2V-6s or -7s, which can search with radar and magnetic detection gear and strike with bombs, torpedoes, depth charges (including nuclear), rockets, mines and such missiles as Petrel and Bullpup. Two 20 mm guns are mounted in the dorsal turret (0.50in in early models) and the majority of current versions have underwing pods housing 3,400 lb-thrust Westinghouse J34 turbojets, supplementing the 3,250/3,500 h.p. Wright R-3350-32W Turbo-Compounds. Many Neptunes have wheel/ski gear. The RB-69 is a U.S.A.F. special-electronics version.

Span, 101ft 6in; length, 91ft 5in; height, 29ft 4in; weight empty, 47,450/49,456 lb (43,950 to 46,046 without jets); gross weight, 78,760 lb (75,310 without jets); max. speed, 345 m.p.h. without jet pods.

Lockheed ASW Electra (P3V?) For many months the U.S. Navy have been evaluating existing military and commercial aircraft with a view to an off-the-shelf purchase of a modified version as a replacement for the P2V Neptune. The Electra transport is the design chosen; and, notwithstanding the need for low-altitude endurance, the turboprop engines have been retained.

Choice of the Electra was announced on April 24. A $2m research and development contract is speeding the engineering changes necessary and an aerodyamic prototype of the ASW version is to fly in August. It is claimed that the new machine "will fly faster, locate targets better and fight harder than any other airplane ever proposed for ASW duty." The 136in-diameter pressurized fuselage will be equipped for a crew of ten, and extensive radar and detection equipment will be carried, including a magnetic anomaly detector in the tail and an APS-20 or similar set under the belly. The engines will be four 4,050 h.p. Allison T56-A-7A.

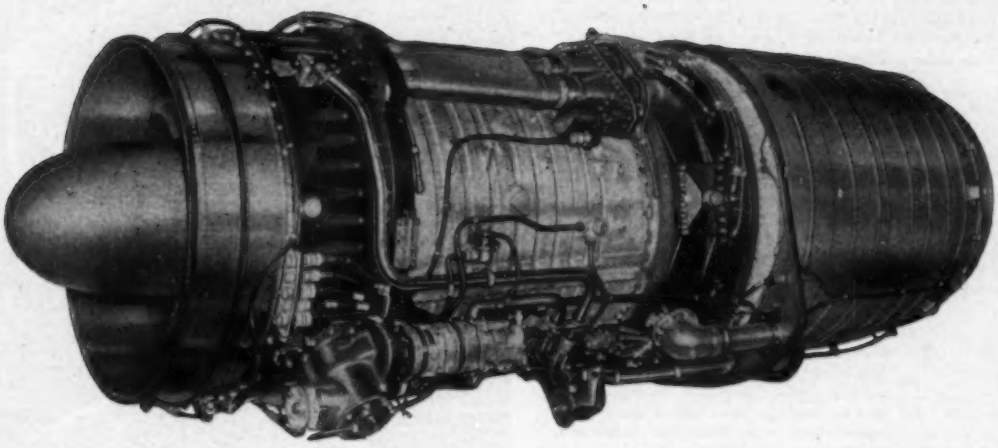
Span, 99ft; length, about 115ft; height, 33ft; wing area, 1,300 sq ft; gross weight, about 120,000 lb; max. speed, about 450 m.p.h.; range at altitude, more than 2,000 n.m.

Sikorsky HSS A special ship-based anti-submarine version of the S-58 (p. 875), the HSS is equipped with a dunking sonobuoy and a variety of weapons. The auto-stabilized HSS-1N has all-weather capability.

RECONNAISSANCE

Douglas A3D-2P and A3D-2Q Skywarrior The A3D-2P version of the aircraft described on p. 868 has a completely pressurized airliner-type fuselage, housing twelve cameras, extensive radar and special reconnaissance gear and a crew of three. The related A3D-2Q carries several tons of countermeasures equipment and an operating crew of seven. The tail guns are retained in both versions.

The Power of Armstrong Siddeley



The Power of Armstrong Siddeley, and its contribution to British aviation, are symbolised in the Sapphire, one of the world's greatest jet engines. Today the Sapphire, with its American equivalent the J-65, is providing the power for no less than 13 front-line military aircraft in Great Britain, the United States, France and Switzerland. Armstrong Siddeley has been associated with British aviation since very early days. Its engines have powered famous aircraft and in turn become famous themselves. Today Armstrong Siddeley are in the forefront of rocket, missile, and gas turbine research, and new shapes of power are constantly being forged. From the past, through the present, the power of Armstrong Siddeley moves into a boundless future.

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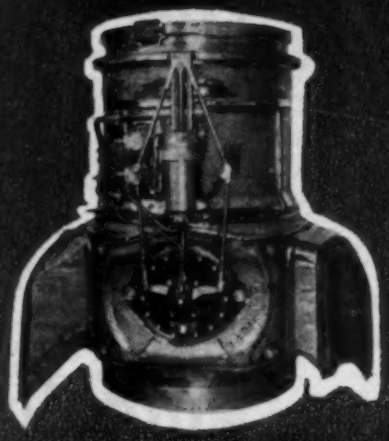

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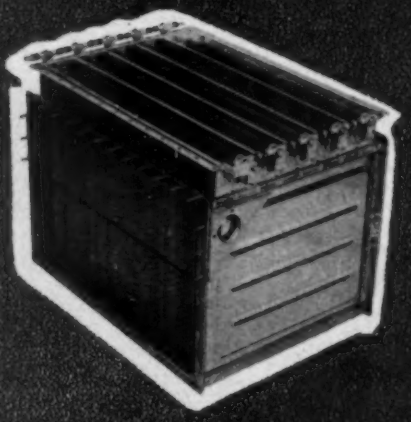
These thermal blankets are made of refractory fibre cased in .004 inch (.1016 mm) stainless steel. They are made-to-measure and are extremely light, the dimpled construction being responsible for their great strength. Specified for Rolls-Royce and Armstrong Siddeley jet and turbo-prop engines, these particular examples are shown fitted to the Rolls-Royce thrust reverser for the de Havilland Comet and Sud-Aviation Caravelle.



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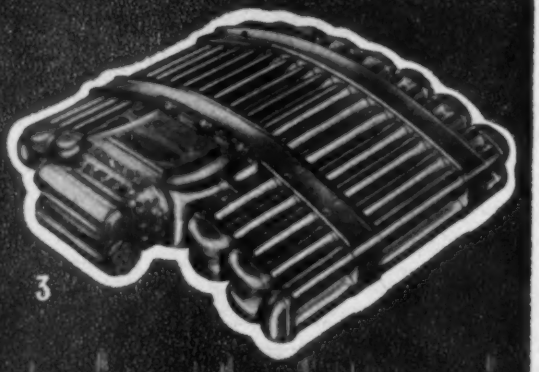
We design, manufacture and supply heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Freightliner and the Vickers Viscount.



3

High pressure fuel-cooled oil cooler for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.

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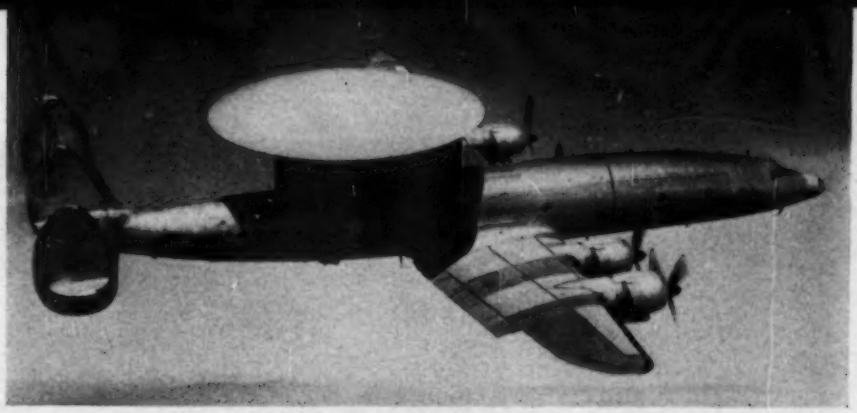


Right, Lockheed WV-2E.

Below, Martin YP6M-1 Seamaster.

Grumman AO-1 Mohawk or OF-1 One of the first STOL aircraft designed for front-line combat duties, the AO-1 is a remarkable machine now under development for the U.S. Army and (OF-1) Marine Corps and Navy. Powered by two Lycoming T53-L-3 turboprops, each rated at 1,005 e.s.h.p., the Mohawk seats two in the nose, with exceptional all-round view; great emphasis has been placed on speed and low-level performance, and the aircraft is designed for operation from short unimproved fields. Equipment includes cameras, resupply containers, flare pods, target-marking rockets or drop tanks, all attached to wing racks. For really adverse terrain, a ski-kit can be installed. The first flight is scheduled for early 1959.

Span, 42ft; length, 42ft 9½in; height, 15ft 7in; wing area, 330 sq ft; empty weight, 7,772 lb; gross weight, 10,423 lb; max. speed, 350 m.p.h.

Grumman WF Tracer The saucer-topped WF-2 Tracer is the successor to the AD-4W Skyraider as the U.S. Navy's carrier-based early-warning radar picket and fighter-control aircraft. Accommodation of the largest scanner ever placed on a carrier-based machine has meant redesigning the wings to fold sideways and changing to a twin-finned tail unit. The fuselage of the WF is actually that of the TF-1 Trader, described on page 873.

Lockheed WV and EC-121 series These are the U.S. Navy and Air Force designations of the Super Constellations used for high-altitude, long-endurance picket duties, particularly at great distances from the American coasts forming DEW-line extensions and fleet screens. Immense sums have been voted for the establishment and upkeep of these machines. Most of those in service—the WV-2 and EC-121D—have a ventral APS-20 radar and a dorsal APS-45 height-finder, both capable of "seeing" some 200 miles from 25,000ft. Operating crew totals 31 or 32; engines are four 3,250 h.p. Wright R-3350 Turbo-Compounds and tankage totals 7,295 Imp. gal. The WV-3 is a special weather reconnaissance version.

Now being intensively evaluated by the Navy Air Development Unit at South Weymouth is the "flying saucer" WV-2E. This retains the APS-45 but uses the surrounding structure to carry the mighty APS-70 radar. The latter has a 37ft scanner integrally mounted with a 40ft dish radome; the entire arrangement—which generates lift but weighs nine tons—is driven by a Vickers hydraulic motor. Maximum reach is expected to be almost twice that of the APS-20.

Span, 123ft 5in; length, 116ft 2in; height, 27ft over scanner; gross weight, 145,000 lb; max. speed, about 300 m.p.h.; endurance, about 18 hr at 25,000ft.

Lockheed U-2 In service with the 4028th Strategic Reconnaissance Squadron of the U.S.A.F., and possibly with other units (as well as the civilian N.A.C.A.), the U-2 was specially designed for extended flight at heights of the order of 60,000ft. Powered by a single Pratt and Whitney J57 turbojet, rated at 10,000 lb thrust, it has a wing of some 90ft span and a stumpy fuselage about 45ft in length housing powerplant, tandem main undercarriage units and the pressurized cockpit (usually with a single ejection seat). Extensive instrumentation is carried for research into such fields as nuclear fall-out, meteorology and upper-air gusts, and special reconnaissance can also be undertaken.

Martin P5M Marlin Although no longer in production, the P5M remains an important patrol flying-boat of the U.S. Navy. Powered by two Wright R-3350-32W Turbo-Compounds of 3,400 h.p. each, it is distinguished by its high-mounted, cranked wing and T-tail. A very extensive assortment of weapons can be carried, including rockets under the wings, heavy stores in the nacelles and twin 20 mm guns in the remote-controlled tail turret; search radar is carried in the nose, a magnetic anomaly detector in the tail and a 130m candlepower searchlight under the starboard wing. Next year the P5Ms are to be given boost turbojets—possibly Vipers.

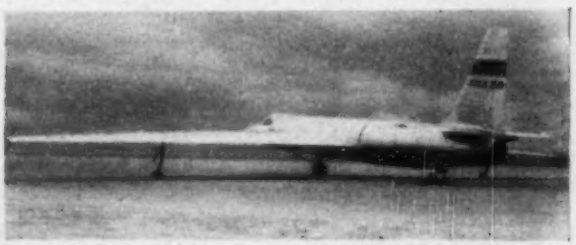
Span, 118ft; length, 98ft 10in; gross weight, 85,000 lb; max. speed, 250 m.p.h.

Martin P6M-1 Seamaster Unique in being a large, jet-propelled flying-boat, the P6M is a multi-purpose minelayer and reconnaissance machine which can operate from the open ocean. Its history has been clouded by the loss of both prototypes during development flying, but the programme is not seriously behind schedule.

The prototypes and six pre-production YP6M-1s differ from the final product in having four Allison J71-A-4 turbojets, each rated at 13,000 lb thrust with short afterburners in use. The first YP6M flew on January 20 and all should be complete by the autumn. The production P6M-2, of which 18 are at present on order, has Pratt and Whitney J75s, each rated

Grumman WF-2 Tracer.

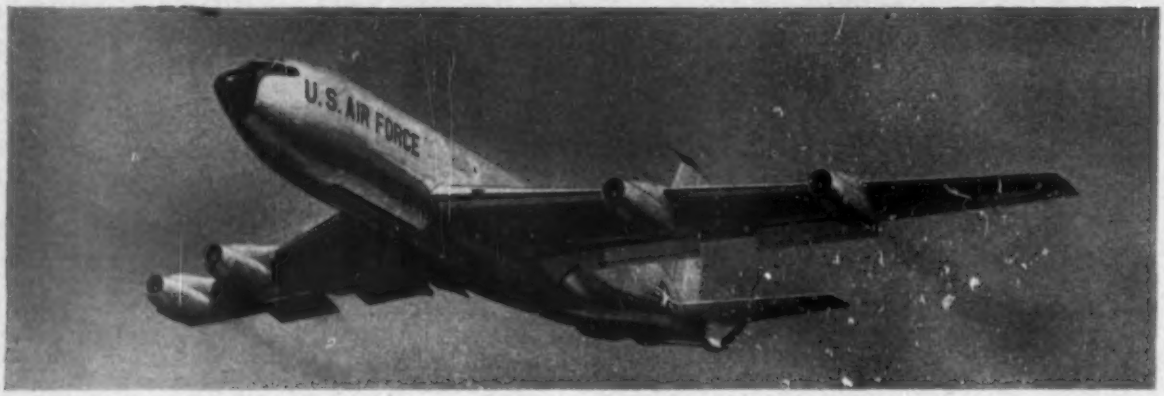
Lockheed U-2 (of N.A.C.A.).



Military Aircraft of the World . . .

Right, Sikorsky HR2S-1W.

Below, Boeing KC-135A Stratotanker.



at some 18,000 lb. The crew comprises two pilots, a navigator/minelayer and a radio and defence systems operator, all seated in the pressurized forward hull. To the rear is a weapons bay, capable of carrying up to 30,000 lb of stores of all kinds, which extends the full depth of the hull and terminates at a watertight rotary door sealed by rubber fingers and pneumatic tubes. Mines, nuclear weapons or a camera pod can be attached to this door while the P6M is beached or afloat.

Defensive armament comprises a remotely controlled tail turret, which in the YP6M-1 has twin 20 mm guns, together with extensive counter-measures. The airframe includes a great deal of honeycomb sandwich structure. All controls are fully powered, and hydroflaps hinged at the aft end of the hull act as air or water brakes, or, when operated independently, as water rudders. In service the P6M will be able to refuel from surface craft and submarines and to operate in sea states up to 6ft waves.

Span, 100ft; length, 134ft; height, 31ft; wing area, 1,900 sq ft; gross weight, 160,000 lb; max. speed, over 600 m.p.h.; unrefuelled combat radius, 1,500 n.m.

Martin RB-57D A small number of these versions of the B-57 (Canberra) are in use for operations at heights in excess of 55,000ft. They are powered by two Pratt and Whitney J57 engines, each of 10,000 lb thrust, and have a new wing with a span increased to no less than 109ft 6in. The fuselage, although basically similar to that of earlier B-57s, is redesigned internally to accommodate a considerable quantity of cameras, radar and special reconnaissance equipment—possibly including television and/or infra-red or passive radar systems.

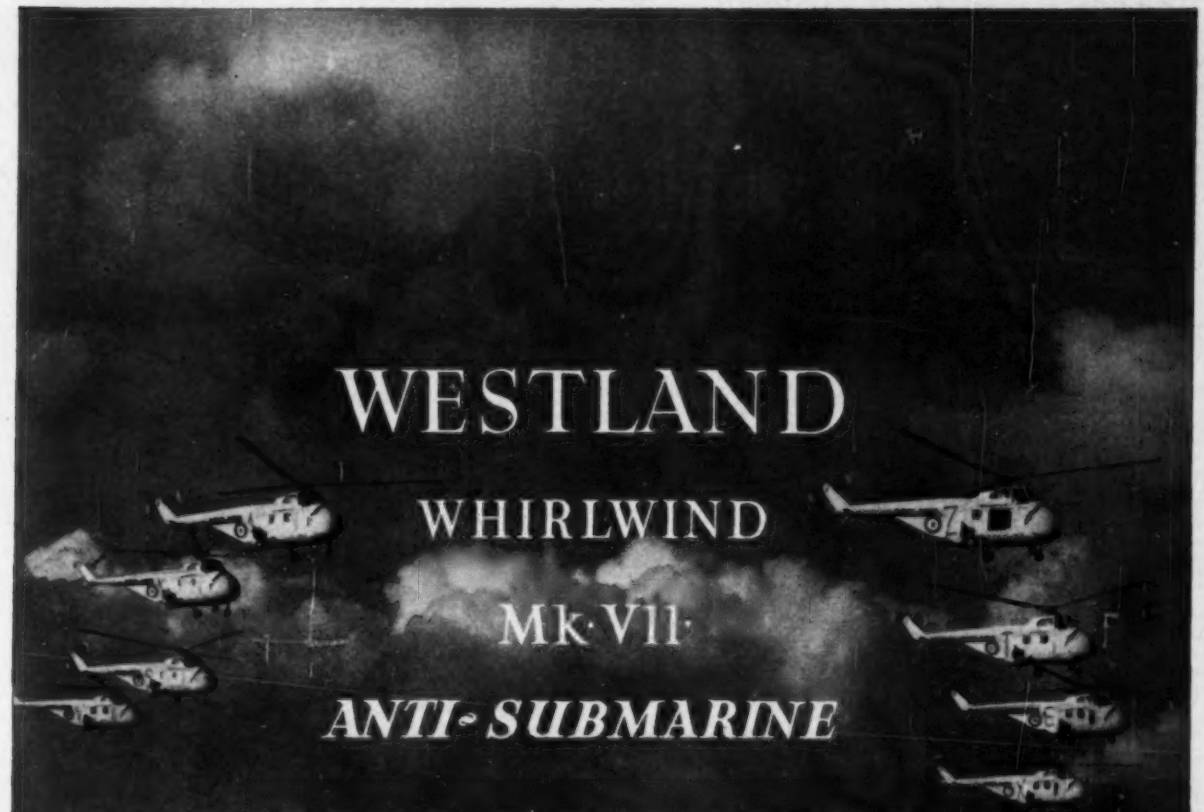
McDonnell RF-101 Voodoo Fastest photo-reconnaissance aeroplane in service in any Western air force, the RF-101A is a derivative of the F-101A (page 865). In fact, numerous examples have been produced by conversion of the fighter, the requirement for the latter having lapsed. Several remarkable sorties have been made by RF-101s, producing a film covering an area 1,000 miles long in one hour. The longer nose of the RF has automatic camera gear but no guns. Many of these machines are being converted in the field to the RF-101C standard, stressed for low-level operations.

Republic RF-84F Thunderflash Powered by a Wright J65-W-3 of 7,200 lb thrust, fed from lateral intakes ahead of the wing leading edges, the Thunderflash is used by the U.S.A.F. Tactical Air Command and by several NATO countries. It carries a Tri-Metrogon camera installation in the nose and other cameras—including the "dicing" low-level system—for use at all altitudes. It can be used by day or night, can be air-refuelled and carries four 0.50in guns.

Span, 33ft 6in; length, 47ft 6in; gross weight, about 24,000 lb; max. speed, about 700 m.p.h.

Sikorsky HR2S-1W A special variant of the S-56 series (p. 875), the HR2S-1W is the only rotary-wing early-warning machine. Designed for shipboard operation, it carries an AN/APS-20E search radar—as shown in the illustration above—and has a crew of five or six.

Douglas C-133A.



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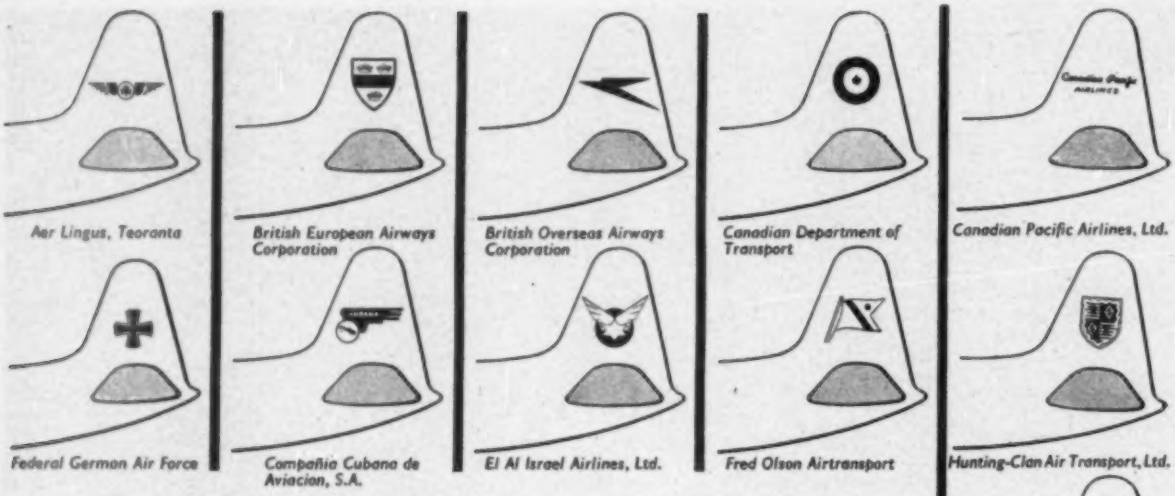

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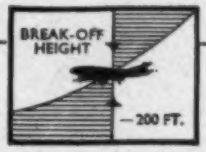

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Military Aircraft of the World . . .

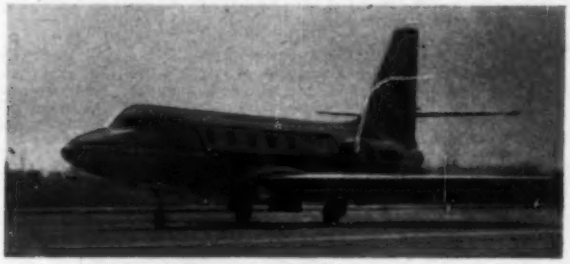
Lockheed C-130A Hercules.

TRANSPORTS

Boeing C-97 Stratofreighter Nearly all the C-97s in the U.S.A.F. are of the last production model, the KC-97G, which is used as a tanker and transport for S.A.C. Powered by four 3,500 h.p. Pratt and Whitney R-4360-59s, the G can carry 68,500 lb of cargo or 130 men; transfer fuel is fed to the receiver aircraft through a rigid boom at the tail. The 888th and last was delivered in July 1956.

Boeing KB-50J The sole surviving member of the Superfortress family to remain in U.S.A.F. service, the J model is the standard tanker for the fighter/bombers of Tactical Air Command. Unlike the S.A.C. tankers it uses the Flight Refueling, Inc., hose system, hose reels being mounted under the fuselage and outer wings. Power is provided by four R-4360 piston engines and two podded J47 jets.

Lockheed CL-329 Jetstar.



Above, Fairchild C-123B Provider; Below, Bell HTL-7.

Boeing KC-135 Stratotanker Essentially similar to the Model 707-120 airliner, except for having a slimmer fuselage with big freight doors and a Boeing refuelling boom at the rear, the KC-135 is to be the standard tanker and long-range transport of Strategic Air Command. It is powered by four J57 engines, but may have more power eventually. Its primary task is to support B-52 wings, and air refuelling squadrons are equipped in the ratio of two tankers to every three B-52s.

The first 40-aircraft KC-135 wing was serving at Castle A.F.B. last July and over 100 have now been delivered. Total orders amount to 345, a vote of just under $203m having been passed in April for an additional 130 aircraft. Further orders, for 26 and then about 140, should bring the total up to some 510. None of the transfer fuel is stored above the floor, which can accordingly accommodate up to 145 passengers or 50,000 lb of freight.

Span, 130ft 10in; length (over boom), 136ft 3in; height, 38ft 5in; wing area, 2,433 sq ft; gross weight, more than 250,000 lb; max. speed, over 600 m.p.h.; cruising range, over 4,000 miles.

Douglas C-133A Developed for the Military Air Transport Service, this impressive machine can carry "96 per cent of all ground-force vehicles" fully assembled, as well as all missiles including the ICBMs. The first YC-133 flew on April 23, 1956. Deliveries of C-133As began last August and about 30 are now in MATS service. Total orders include 6 pre-production machines, 33 in the first operational batch and run-on orders extending deliveries into 1961.

Power is provided by four Pratt and Whitney T34-P-7W turboprops each rated at 6,000 e.s.h.p. The interior provides 13,028 cu ft of usable space on a floor 90ft by 11ft, the whole being pressurized to 7½ lb/sq in dP. Internal fuel amounts to 15,051 Imp. gal. There are four main wheels arranged in independent fore and aft pairs retracting into large fuselage bulges, the port bulge also housing two turbine auxiliary powerplants and the air-conditioning system.

Span, 179ft 8in; length, 157ft 6½in; height, 48ft 3in; track, 20ft 1in; wheelbase, 58ft 11in; wing area, 2,673 sq ft; weight empty, from 111,715 to 116,191 lb; gross weight, 275,000 lb (alternate, 282,000 lb); max. speed, 308 kt at rated power; cruise at 272 kt; range with max. cargo (114,993 lb), 1,330 n.m.; range with max. fuel (41,700 lb cargo), 3,700 n.m.

Douglas/Convair SC-54 Originally built as C-54 (DC-4) transports, a large number of these aircraft have been turned into SC-54 air/sea-rescue machines by the Fort Worth division of Convair. Major modifications include a completely new interior, with a repositioned navigator's station, new cockpit equipment, bunks, scanning blisters, a large door for equipment dropping, extra fuel and oil tanks and comprehensive electronics.

Fairchild C-123B Provider Originally designed by Chase Aircraft, the C-123 has been built in quantity by Fairchild (as lowest bidder to a U.S.A.F. tender in 1953) and 300 should have been delivered when contracts are completed at the end of this year. Powered by two 2,500 h.p. Pratt and Whitney R-2800-99W engines, the C-123B carries all its fuel in jettisonable tanks: two 609 Imp. gal tanks in the nacelles and two underwing tanks of 375 Imp. gal each. The unpressurized hold has a volume of 3,570 cu ft and can seat 60; maximum cargo load is 18,000 lb (16,000 normal) and heavy dropping is possible. Recent improvements being effected retroactively include wheel/ski gear and tip-mounted J44 booster jets, of 1,000 lb thrust each.

Span, 110ft; length, 76ft 3in; height, 34ft 1in; wing area, 1,223 sq ft; empty weight, 31,620 lb; gross weight, 60,000 lb; max. speed 208 m.p.h.; range, 1,000 miles with max. cargo at 186 m.p.h.; landing speed, 85 m.p.h.

Grumman TF-1 Trader Derived from the S2F Tracker (page 870) the Trader is in extensive service as the standard fixed-wing transport between U.S. Navy carriers and shore bases. The interior can be equipped for nine passengers, some two tons of freight or for other special purposes such as logistic support. It can fly off any carrier fully loaded, has all-weather capability and has required less than three maintenance hours per flight hour.

Lockheed C-130 Hercules It is fair to assess this multi-purpose transport as the founder of the modern fashion for such vehicles. The YC-130 flew on August 27, 1954, and first deliveries of the C-130A were made to the U.S.A.F. Tactical Air Command in December 1956. Power is provided by four 3,750 e.s.h.p. Allison T56-A-1A turboprops.

Although there is a rear door, for loading or air-dropping, measuring 10ft by 9ft 2½in, the whole interior is pressurized to 7½ lb/sq in differen-

Military Aircraft of the World . . .

Kaman HU2K-1 (Mock-up).

Below, Cessna L-27A.

tial. Usable volume, excluding the flight deck, is 4,300 cu ft, and maximum cargo load 35,000 lb. Several special versions of the C-130A have been evolved, with wheel/ski gear, transfer tanks and drogues, drone pylons and command control, mapping and charting equipment and for other functions. Lockheed's Marietta plant has built about 170 of the total order for 231 C-130As, twelve of which will go to the R.A.A.F.

In December the first C-130B will be completed. Powered by 4,050 h.p. T56-A-7As, with four-paddle-blade propellers, the B weighs 135,000 lb and has increased payload and range. At present the U.S.A.F. have bought 53 of this model, for $100m, and the U.S. Coast Guard two.

Span, 132ft 7in; length, 97ft 9in; height, 38ft 9in; wing area, 1,745 sq ft; empty weight, 58,700 lb; gross weight, 124,200 lb; max. speed, 369 m.p.h.; cruising speed, 354 m.p.h.; range with full payload, 1,800 n.m.; range with 25,000 lb payload, 2,500 n.m.; take-off to 50ft, 3,150ft; initial climb, 2,300ft/min.

Lockheed CL-329 Jetstar Designed to meet the requirements of the "off-the-shelf" U.S.A.F. competition for the UCX utility transport/trainer, the Jetstar is a 28,000 lb jet transport seating up to 20. The two prototypes have twin Wright TJ-37 (Bristol Orpheus) engines, but an alternative is four G.E. J85s or Fairchild J83s. The budget request for this machine was turned down by Washington but the programme is not suspended.

McDonnell Model 119 This jet transport was designed to the U.S.A.F. UCX specification. It resembles a scaled-down DC-8. Money for production is unlikely to be voted but a prototype is nearly complete.

North American Sabreliner Powered by twin G.E. J85 or Fairchild J83 turbojets, this machine meets the U.S.A.F. UTX specification for a combat-proficiency trainer and liaison transport. Seats are provided for two pilots and four passengers.

GENERAL PURPOSE, LIAISON AND SPOTTING

Beech L-23 Seminole Almost identical to the civilian Twin-Bonanza, the Seminole is a full six-seater, capable of cruising at up to 225 m.p.h. on a pair of 295 or 340 h.p. Lycomings. Many L-23s, of various versions, are used by the U.S. Army for general communications.

Bell 47 series About 60 per cent of the 2,000 Model 47s built are military. The latest variants of this versatile helicopter are the H-13H Sioux (Army 47G-2), which will remain in production until next March, and the Service derivatives of the 47J Ranger. The latter include the Air Force H-13J (one of which is used by the President) and the Navy HUL-1 and the HTL-7 instrument trainer. These latter machines are powered by a 200/220 h.p. Lycoming flat-six, mounted vertically, and seat a pilot and three passengers.

Bell HU-1A Iroquois Originally designated H-40, the HU is a turbine-powered machine designed in 1955 to the requirements of an Army competition and now coming into general service. Powered by a Lycoming T53 free-turbine unit rated at 825 s.h.p., the HU seats six in its broad and roomy cabin, has an outstanding performance and is designed for an overhaul life of 1,000 hr in arduous front-line service. An enlarged development will have a lighter, narrower fuselage, and will be able to lift 12 troops or 3,000 lb cargo in lateral nacelles for a range reported to be 1,000 n.m.

Rotor diameter, 44ft (two blades); overall length, 57ft; empty weight, 3,670 lb; gross weight, 5,620 lb; max. speed, 151 m.p.h.; vertical climb at s.l., 1,900ft/min; range, 200 miles.

Cessna L-19 Nicknamed Bird-Dog, the L-19 is the most widely used U.S. Army fixed-wing aeroplane, serving for general liaison and observation, wire-laying, instrument training and like duties. There are two seats in tandem and the engine is a 213 h.p. Continental O-470. Approximately 3,000 are in use. The related OE-1 is used by the U.S. Marine Corps.

Cessna L-27A An initial batch of 80 of these military versions of the rakish Model 310B civilian light twin was bought by the U.S.A.F. in 1957. Seating five, and cruising at well over 200 m.p.h. on the power of two 240 h.p. Continentals, the L-27A is used for manifold tasks. It is maintained through Cessna dealers.

Cessna OE-2 Although only a two-seater the OE-2 is larger than the L-19/OE-1, having a 265 h.p. engine. It is used by the Marine Corps.

Hiller XROE-1 Although Hiller's chief product is the familiar H-23 series of three-seat helicopters (used by the U.S. Army as the Raven), the XROE-1 is a novel design which may be accepted by the U.S. Army for battlefield use. Powered by a 40 h.p. Nelson piston engine, the machine can be rapidly assembled in the field from a compact kit of parts, and provides transport for one soldier for some 27 miles at up to 70 m.p.h. The type was further described in our issue of May 23.

Hiller XROE-1.

Bell HU-1A Iroquois.

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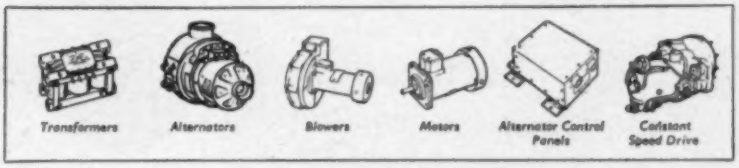
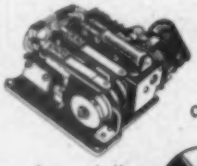


AE31

TIME SWITCHES

Time Switches—non-resetting, resetting and cycling, are widely used on many of to-day's aircraft for such applications as; gas turbine engine and rocket motor starting  inching mechanisms for power operated flying trim controls, camera gun operation, navigation light flashing units, civil and military; de-icing heater mat cycling units automatic bomb release switches and units designed to provide a fixed duration pulse at selectable intervals.

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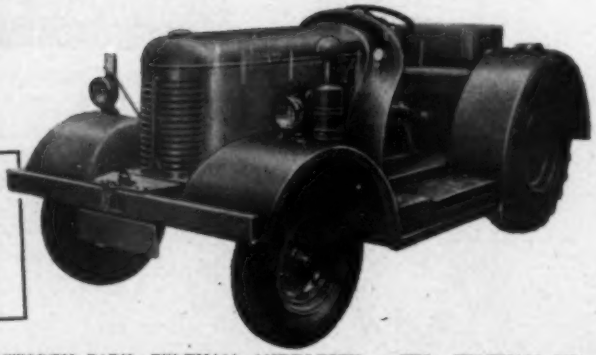

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Military Aircraft of the World . . .

Kaman HU2K Not yet in production, the HU2K has a single, four-blade rotor driven by a 1,000 h.p. General Electric T58 free turbine. It is to be the standard Navy utility helicopter, and will probably seat about seven persons. An unusual feature is a fully retractable undercarriage.

Kaman K-600 series A large number of versions of this intermeshing-rotor helicopter are used by the Marines (as the HOK), Navy (HUK) and Air Force (H-43). Usually powered by a 600 h.p. Pratt and Whitney R-1340-28 radial, they are employed for a great variety of tasks, seating up to five (2,000 lb cargo). The H-43 is the standard crash-rescue machine of the U.S.A.F.; the H-43B has the 825 h.p. Lycoming T53 free-turbine engine and seats eight.

Rotor diameter, 47ft; max. gross weight, 6,800 lb; max. speed, 110 m.p.h. (H-43B, about 145 m.p.h.).

Martin B-57E This conversion of the B-57 (Canberra) is widely used throughout the U.S.A.F., and in joint-service establishments, as a target tug. Sleeve and banner targets can be streamed from a pair of large canisters under the rear fuselage and Radop frangible ballistic targets, and similar small drogues, can be towed from racks beneath the outer wings. Most B-57Es retain their full ability as bombers.

Sikorsky S-56 series Used by the Army as the H-37A Mojave and by the Navy and Marines as the HR2S, the S-56 is a big, ungainly helicopter with a single five-blade rotor powered by two 1,900 h.p. Pratt and Whitney R-2800-50 piston engines in external nacelles. Features include clamshell nose doors, retractable twin-wheel main undercarriage units, complete autostabilization, de-icing, an internal 2,000-lb hoist for cargo handling, external drop tanks and folding tail and main rotor. Payload can include 36 troops or any stores up to about 11,000 lb total. Records established (and since broken) include 162.7 m.p.h. speed and, as an example of load-to-height records, a payload of 13,250 lb to 7,000ft.

Rotor diameter, 72ft; fuselage length, 42ft 2in; empty weight, 19,500/20,455 lb; gross weight, 28,500 to 31,000 lb; normal max. speed, 140 m.p.h.; best climb at s.l., 1,140ft/min.

Sikorsky S-58 series Many hundreds of these big single-engined helicopters are in use under the following designations: U.S. Army, H-34 Choctaw; Navy, HSS; Marines, HUS. All are powered by a 1,525 h.p. Wright R-1820-84 piston engine, driving a four-blade rotor; fuel capacity varies from 166 to 256 Imp. gal. The payload can be 12 passengers, eight stretchers or some 3,500 lb cargo carried internally or suspended from a sling. Many are equipped with an electronic "hands-off" autostabilizing unit. Some H-34s have ground-attack armament.

Rotor diameter, 56ft; length, 46ft to 47ft 2in; empty weight, 7,560 lb; gross weight, 12,700 lb; max. speed, 130 m.p.h.

Vertol H-21 series Several hundreds of these distinctive tandem-rotor machines are used by the Army (H-21C Shawnee), Air Force (H-21B) and other countries—notably France, in N. Africa. Normally powered by a 1,425 h.p. Wright R-1820-103 piston engine, the H-21 is capable of carrying 20 troops, and an H-21C once flew for 1,199 miles with overload tanks. Extensive battle-protection is built in, and Shawnee armament can include 14 folding-fin rockets, two 0.30in and two 0.50in guns.

Rotor diameter, 44ft; overall length, 86ft 4in; empty weight, 8,600 lb; gross weight, 15,000 lb; max. speed, 140 m.p.h.

TRAINERS

Beech T-34 Mentor A standard primary type, these tandem-seat trainers are used by the U.S.A.F. (T-34A) and Navy (T-34B). The T-34 is manufactured in Japan and has been exported to seven other nations, particularly in S. and Central America. Powerplant is a 225 h.p. Continental, and features include a retractable nosewheel undercarriage, radio and optional light armament (bombs and two guns).

Cessna T-37A The only jet primary trainer used by the U.S.A.F., the T-37 is a side-by-side machine powered by two Continental J69 turbo-jets, each rated at from 920 to 1,050 lb, mounted in the wing roots. The prototype flew in October 1954 and production deliveries began last year. Output is currently twelve monthly, and is rising; about 145 have been delivered, at a unit cost of some $158,000 each, and they are serving in civilian contract schools.

Span, 33ft 10in; length, 29ft 3in; height, 9ft 4in; gross weight, 6,403 lb; fuel capacity, 258 Imp. gal; max. speed, 366 kt; range with reserves, 700 n.m. at 268 kt at 35,000ft; stall at gross weight in landing configuration, 72 kt.

Douglas A3D-2T Skywarrior This version of the aircraft described on page 868 has a completely pressurized airliner-type fuselage equipped with stations for a captain, instructor and six students. Very extensive radar bombing gear and navigational aids are carried and weapons can be dropped from wing racks. The tail guns are retained.

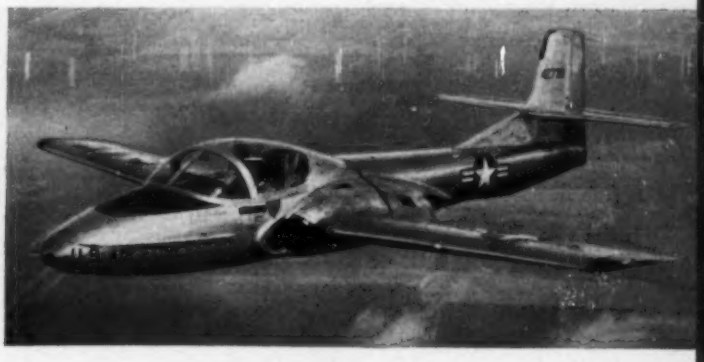
Lockheed T-33 (TV) Six thousand of these tandem-seat trainers have been built and the type is in service with all U.S. armed services and many other air forces. Powered by a 5,200 lb-thrust Allison J33, it is also being built in Japan (by Kawasaki); Canadair have built a Nene-powered version (*q.v.*).

Lockheed T2V-1 SeaStar Originally a private venture, the T2V is now in bulk production as the standard advanced seagoing trainer of the U.S. Navy. It is completely redesigned from the TV (T-33) but retains a basically similar engine, the Allison J33-A-22 or A-24, of 6,100 lb thrust. It was the first production aeroplane with blown flaps, supersonic nozzles directing compressor bleed air over the flaps to improve low-speed behaviour and reduce stalling speed. Other features

Sikorsky HUS-1 lifting Cessna OE-1.

Kaman H-43B.

Cessna T-37A.



Military Aircraft

of the World . . .

Northrop T-38 (mock-up).

Below, Lockheed T2V-1 SeaStar.

include leading-edge slats, increased tail area, stronger undercarriage, raised instructor (rear) seat and full carrier equipment. The first T2V flew in December 1954. Ten had been delivered at the beginning of 1958 and many more are now in use; the bulk contract covered 271 aircraft, costing $61m.

Span, 42ft over 169 Imp. gal tip tanks; length, 38ft; height, 13ft; gross weight, 16,400 lb; max. speed, 600 m.p.h.; initial climb, 6,330ft/min; range, 840 n.m.; landing speed, 97 m.p.h.

North American T2J-1 Winner of a U.S. Navy design competition for a new general purpose trainer, the T2J has been designed and built by North American's Columbus division. The first example flew on February 10. Development has been accelerated by employing a wing similar to that of the FJ-1, flying controls similar to those of the T-28C (plus a powered tailplane) and standard systems and equipment wherever possible.

Pilot and pupil sit in tandem; the Westinghouse J34-WE-46 turbojet of 3,400 lb thrust is in the belly, fed from cheek intakes and exhausting at the wing trailing edge; and the main fuel tank occupies the fuselage above the wing. Full carrier equipment is carried and a variety of packages can be installed housing guns, bombs, rockets or towing gear. Modified Martin-Baker seats are expected to provide safe escape at ground level. Quantity production is already in hand, although evaluation at Palmdale has yet to begin.

Span, 36ft; length, 38ft 4in; height, 14ft; wing area, 225 sq ft; empty weight, 6,500 lb; gross weight, 9,850 lb; max. speed, 429 kt; landing speed, 67 kt; performance to 50ft, take-off 2,010ft and landing 1,690ft; range with 483 Imp. gal, 840 n.m.

Northrop T-38 This remarkable machine is stated to "fill the need for a trainer aircraft with a performance capability matching the characteristics of supersonic operational aircraft." Powered by two General Electric J85 or Fairchild J83 turbojets, each rated at about 2,500 lb with afterburner, the T-38 is to be used for the following functions: supersonic techniques in general; multi-jet handling; aerobatics; night flying; instrument training; and cross-country navigation.

Ailerons, rudder and slab tailplane are fully powered, with spring, or spring/bob-weight, feel. The thin wing has practically no sweep, and has mid-span ailerons and small flaps. The fuselage is markedly area ruled, the instructor sitting behind and above the pupil. All fuel is carried between the engine intake ducts, the cells occupying the full fuselage cross section. The T-38 is in production and is intended to succeed the T-33 as a standard trainer. First flight is scheduled for next January.

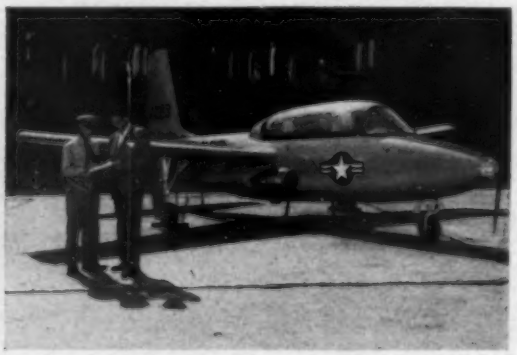
Span, 25ft 2in; length, 44ft 1in; height, 11ft 11in; gross weight, 10,960 lb; max. speed, about 850 m.p.h.; range, more than 1,000 n.m.

Temco TT-1 Pinto This trim little machine was the first primary jet trainer to be adopted by the U.S. Navy. It has tandem ejection seats, an extremely advanced structure stressed to a factor of 11.25, hydraulic speed brakes, liquid oxygen breathing and a single Continental J69-T-2 engine of 920 lb thrust. The prototype flew in March 1956; following successful evaluation an order was placed for 14, the first of which was delivered last September. Further orders are likely.

Span, 29ft 10in; length, 30ft 7in; height, 10ft 10in; gross weight, 4,400 lb; max. speed, 286 kt; initial climb, 1,900ft/min; stalling speed at 4,000 lb, 67-69 kt.

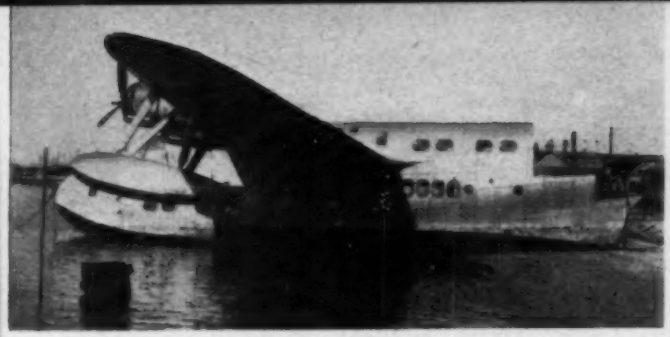
North American T2J-1.

Temco TT-1 Pinto.



CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.



Solent G-AHIL derelict (see letter "Last at Poole," below).

The Cody Controversy

THE letter from Mr. Geoffrey Dorman in *Flight* for June 6 strikes at the basis of all serious historical studies. The only true historical method is the reliance upon contemporary records, cross-checked for accuracy wherever possible: memory can enrich the knowledge so gained, and enable us better to enter into the minds and thoughts of the pioneers, but it cannot be trusted on crucial questions of fact or dates. It is overmuch reliance upon memory that has bedevilled so much aeronautical history; Capt. Pritchard, and now Mr. Gibbs-Smith and others, are doing a most valuable service by turning to more reliable methods.

Reliance upon memory in preference to records will produce not history but reminiscences.

So far as Mr. Hurren's related argument is concerned, it would be odd if a man left no written record, published or unpublished, of his first flight, and had made no reference to it when describing his later flights. Incidentally, were there any aeronautical activities at Eastchurch or Hendon in May 1908?

I suspect that the case of what happened on Sir Alliott Verdon-Roe's flight trials at Brooklands in June 1908 is more difficult to settle than that of Cody's May trials; here we do have contemporary accounts, but they do not say Roe flew: his letter to Wilbur Wright in August refers to towed flights, and an article in *Aeronautics* for June 1909 states: "Owing, however, to insufficient motive power, no actual flights were made." Yet in 1912 various men stated that they had seen Roe fly. I should like to suggest that the explanation could be that Roe had left the ground for a short distance, aided by the downhill gradient at the top of the Finishing Straight; and, naturally enough, did not consider this showed his machine could fly. But the conflict of evidence remains confusing, and the weight of it seems to be against the claim that Roe made the first flight in England.

Walton-on-Thames, Surrey. DAVID SAWERS.

EXTRACT from *L'aérophile*, November 1, 1908: *"Chute de l'aéroplane militaire anglais:* Après plusieurs semaines d'essais presque quotidiens au camp d'Aldershot, l'aéroplane TONILEA, construit pour le War Office, sous les ordres de son inventeur, le colonel Cody, paraissait absoluement au point.

"Le jeudi 15 octobre, l'aviateur résolut de tenter enfin son premier vol. Après avoir roulé quelques mètres, l'appareil s'enleva, et, parfait de stabilité, parcourut entre 3 et 4 mètres en ligne droite.

"Mais le colonel, pour éviter un bouquet d'arbres, voulut virer trop brusquement et l'aéroplane, déséquilibre, s'abattit lourdement. L'aéroplane a été completèment détruit. Le colonel Cody est indemne."

London, W.1. F. H. SMITH,
Librarian, Royal Aeronautical Society.

Last at Poole

THE breaking-up of Short Solent G-AHIL *City of Salisbury* is now advanced and brings to an end the link between air transport and the marine airport at Poole, after two decades. This particular machine was originally allocated to B.O.A.C. but as far as I know was not used on their services, since it reverted to the M.C.A. and for several years has been one of a group moored in the Wareham Channel dispersal area. The enclosed photograph, taken in mid-April, shows *City of Salisbury* awaiting a spring tide in order to float her farther up the beach at Hamworthy to facilitate the removal of the engines.

A few trial runs with flying-boats at Poole were made prior to the war, but regular operations did not begin until September 3, 1939. Subsequently, besides normal C- and E-class boats, the Saro-Guiness "air yacht," a Cloud and various Qantas boats were moored in the main channel. *Mercury* (G-ADHJ) called several times, and *Maia* (G-ADHK) was destroyed by enemy action one night; her sister aircraft in Wych Channel—the PBY *Guba*—was damaged at the same time.

Sunderland and Catalina squadrons were based upon Salterns and Hamworthy, whilst H.M.S. *Dædalus* flew Walrus, Kingfishers and Seafoxes from Sandbanks, at the southern end of the harbour, where a coastal flight of A.S.R. Walrus were also based. One so far unidentified type flown by *Dædalus* was a machine resembling a Vickers Venom—but with two seats and with three floats, similar to the Kingfisher. The radial engine made as much noise as any three Harvards. [Kingfisher with square-tipped wings, or Curtiss Seamew?—Ed.]

At this period one day saw G-AEUG *Coogee*, G-AFBJ *Carpentaria* and G-AFCI *Golden Hind* milling about at Poole with all the others. Still later two R.A.F. Coronados used the base, together with the Boeing Clippers and a Sikorsky VS-44.

Finally, Sandringhams, Sunderlands, Hythes and Solents came and went, leaving only five of their number awaiting sale. One went to Aquila and one to South Pacific Airways; the rest are now awaiting their end.

Surbiton, Surrey. JOHN GAYLARD.

Postprandial Poundage

I NOTICE that in your report of Mr. Rumbold's dinner ["The Industry," May 30] you mention my reference to "2½ megaton lb (or pounds sterling—he did not specify which)." My actual statement was, or should have been, 2½ mega*pounds* sterling"—one megapound sterling meaning, of course, in the modern idiom, one million pounds sterling. I hope this makes the matter clear.

Hatfield, Herts. C. T. WILKINS.

Updraught

YOUR picture "Quieting Vulcan's Forge" (June 6, page 759) makes one wonder whether we may expect the Vulcan's ground silencers to be adopted shortly by seagulls and glider pilots as legitimate "thermals."

If ruffled feelings (or feathers) are to be avoided, I suggest that an authoritative statement be issued at once.

Leek, Staffs. A. R. MARGARY.

Who was Jatho?

WITH reference to Roger Bacon's comments ("Straight and Level," May 30) on the commemorative stone at Hanover, the name "Jatho" seems to be a personal one. I cannot place him from memory, but possibly some such source as M. Dollfuss's *Histoire de l'Aéronautique* would have a reference.

However, the translation given is somewhat in error. The inscription reads "*To the* first motor-powered *flier* of the World." "Flight," of course, would have been "*Flug*."

Southampton University. DENYS J. VOADEN.

Early Air-brakes

ALTHOUGH I came into the picture much later than Mr. Eric Arnsby [Correspondence, May 23] it might be of interest to him to know that, as far as I can remember, no air-brakes were fitted to the 1½-Strutters supplied to the cruisers from which these aircraft were launched. I did a few hours on the 1½-Strutter when I was not flying Camels and can well remember one launching from a cruiser which nearly resulted in my hitting the water just ahe d of the ship.

It may be that air-brakes were there and I had not been told about them, but it is more likely that I was overloaded carrying a 50-lb bomb.

It is probable that after 1917 no one bothered to use the air-brakes, resulting in a modification which dispensed with it.

Kenley, Surrey. ERIC BREWERTON.

Unsung Heroes of 1914-18

I WAS most interested in Mr. Malone's letter (May 16) concerning the late Air Marshal Conyngham, Capt. Glennie of No. 7 (R.E.) Sqn. and Capt. Carberry of No. 59 Sqn. I think Mr. Malone is rather modest about his knowledge of 1914-18 aircraft and airmen; for I have a suspicion, on reading his previous letters, that he was one of the latter, and could, with a little encouragement, write some good gen on these forgotten squadrons. Capt. Carberry's exploit brings to mind Capt. D. Grinnell-Milne's affair with a German battery when one of his "eggs" blew up an ammunition dump, blew off half his tail, and wiped off his undercarriage when his S.E.5a hit the ground! In this unhappy state Capt. Grinnell-Milne staggered home and crash-landed behind the British lines.

This brings me to another question. Did any of the fighting powers produce an aircraft with a retractable undercarriage during the 1914-18 war—a prototype, for instance?

Birmingham, 14. MAURICE AUSTIN.

CORRESPONDENCE . . .

Patents and Publication

YOUR correspondent Mr. E. V. Hammond (May 30) remarks that a little delving into patent specifications of the past would frequently disclose that the basic principle of a new device was old. I suggest this indicates that invention by itself is not very difficult compared with designing and building the real thing. In modern conditions those who are qualified and equipped for design also have ample opportunities and inspirations for invention.

Nevertheless, the "lay" inventor has an important new rôle to play: he can publish his ideas without fear of disclosing anyone's secrets but his own. Moreover, he may well earn more in literary fees than he ever would by selling patents, particularly as copyright costs nothing and lasts for 50 years.

How nice it would be if we could refer to a sensible description of Mr. Hammond's retractable wings in the press of 1917 (or 1958) instead of to the legal jargon and absurd diagrams of a patent specification!

Kingston-upon-Thames, Surrey. R. COX ABEL.

CORRESPONDENCE IN BRIEF

W/C. R. F. Martin, Gloster chief test pilot, writes to say that he has had "a most gratifying response" to his letter (May 30) asking for information about squadron markings for the last airworthy Gladiator, which his company has been restoring to operational standard. He adds: "The question of the markings and number is completely cleared up and the aeroplane is now being re-sprayed."

* * *

Mr. G. Bishop, 106 Cavendish Road, Leicester, would be grateful for information concerning the manufacturers and history of the airship *City of Glendale*.

FORTHCOMING EVENTS

June 15-29. World Gliding Championships, Poland.
June 19-28. OSTIV: Seventh Congress, Osieczna, Poland.
June 20-23. Lerida Aero Club: International Tour of Pyrenees.
June 20-23. Palermo Aero Club: Tour of Sicily.
June 21. R.N. Air Station Ford: At Home.
June 22. R.Ae.S.: Garden Party, White Waltham.
June 25. Kronfeld Club: Polish film, "The First Start."
June 27. D.H. Technical School Old Boys' Association: Midsummer Ball, Water End Barn, St. Albans.
June 27-29. Royal Dutch Aero Club: International Rally.
June 28. R.A.F.A. (S.W. Area) and Exeter Aero Club: Flying Display, Exeter Airport.
June 28. R.A.F.A. (Midland Area): Air Display, Staverton Airport.
June 28. R.N. Air Station Abbotsinch: At Home.
June 28-29. Fiers Aero Club: Normandy Rally.
June 28-30. R.Ae.C.: Private Air Rally, Le Boulo.
July 4. College of Aeronautics Students' Society: Presentation Ball, Cranfield.
July 5. NATO Air Display: Soesterberg, Holland.
July 5-6. Aéro Club de l'Ouest: Anjou Wines Rally.
July 5-7. R.Ae.C.: Private Air Rally, Deauville.
July 8. Kronfeld Club: Welcome home to British gliding team.
July 8-11. Institute of the Aeronautical Sciences: National Summer Meeting, Los Angeles, Cal.
July 10-12. R.Ae.C.: National Air Races and Lockheed International Aerobatic Competition, Baginton.
July 12-14. Royal Dutch Aero Club: Camping Rally.
July 13. Wolverhampton Aero Club: At Home, Wolverhampton.
July 13. Leicestershire Aero Club: At Home, Leicester East.
July 16. Kronfeld Club: "The London Gliding Club," by Dudley Hiscox.
July 19. R.N. Air Stations Eglinton and Culdrose: At Homes.
July 19-20. Calvados Aéro Club: Caen Rally.
July 26. R.N. Air Station Lossiemouth: At Home.
July 26-27. Trente and Bolzano Aero Clubs: Dolomites Circuit.
July 26-Aug. 4. B.G.A.: National Soaring Week.
Aug. 1-16. Czech Aero Club: World Parachute Championship, Bratislava.
Aug. 2. R.N. Air Station Brawdy: At Home.
Aug. 2-4. Plymouth Aero Club: Rally.
Sept. 1-7. S.B.A.C. Display and Exhibition, Farnborough.

THE INDUSTRY

G/C. Ridley Joins Masteradio

AN Assistant Director, Electronics Research and Development, at the Ministry of Supply for the last four years, G/C. L. R. Ridley, O.B.E., has retired from the R.A.F. and is joining Masteradio, Ltd., and its subsidiary, R.M. Electrics. He will be responsible for the radar and electronics division.

G/C. Ridley, who had worked under Sir Robert Watson-Watt in the early days of radar development, was at Biggin Hill during the Battle of Britain, where he was responsible for maintenance of the radar network in the S.E. Sector; and during the enemy's night "blitz" he commanded No. 75 Wing which, under 60 Group, was responsible for the efficiency of the radar system protecting the London area. Later he saw service in France and Germany, and after the war did a tour of duty at H.Q. Middle East Air Force.

Masteradio were concerned with the development of the original Eureka Mk 1 and Rebecca Mk 1. From this equipment emerged the portable radar landing beacon, much used in combined operations and for the landing of agents in enemy territory, and the S.O.S. transmitters used in ships' lifeboats. The company became specialists in vibrator-operated power packs for use with radio transmitters and these are among their products today; others include receivers, public-address equipment, scientific apparatus and emergency power-supply systems.

Aviation Films at Brussels

TWO short aviation films were among those shown at the World Festival of Films which was held in Brussels and ended on June 14. This festival embraced experimental, short and feature films, and was designed as part of the 1958 Exhibition to show what is currently being done in the cinema.

Jet Provost, an 18-minute film made for Hunting Aircraft by Larkins Studio in association with the Film Producers Guild is, of course, about the Hunting basic jet trainer. The film illustrates the layout, servicing, economics and flying capabilities of the aircraft. The diagrammatic sequence designed to show that a pilot can be trained on the Jet Provost less expensively than on piston aircraft is particularly well done. At the festival the film was shown in an English version but, with international screening in mind, versions are also being prepared in Spanish, Portuguese and Arabic.

The other flying film shown, *The Golden Lizzy*, is a 17-minute record of an aviation day held in Holland and attended by Queen Juliana and the royal princesses. A Dutch entry for the festival, and sponsored by Royal Dutch Shell, the film is distinguished by some particularly good air-to-air shots.

IN BRIEF

The annual report of the R.F.D. Co., Ltd. (circulated in advance of the general meeting on June 27), states that the group's net profit for 1957 amounted to £135,530—to which has to be added the sum of £65,509 received in final settlement of fire-insurance claims. (Satisfactory progress with rebuilding work at Godalming is reported in the chairman's statement.) The balance brought forward at January 1 this year was £24,326, making a total of £225,365 (1956, £154,524). With taxation at £99,566, £125,799 remains.

* * *

Tiltman Langley, Ltd., the design and development engineers, of Redhill Aerodrome, Surrey, announce that Mr. J. C. Stevenson, B.Sc., F.R.Ae.S., has been appointed chief technician, and Mr. E. F. Maillard, B.Sc.(Chem.), A.R.I.C., A.I.M., has been appointed metallurgist. Mr. Stevenson was formerly with Saunders-Roe, Ltd., where as chief aerodynamicist he has been responsible for much of the aerodynamic/hydrodynamic work on their various projects during the past 20 years. Mr. Maillard was chief metallurgist and chemist at Essex Aero, Ltd.

Sir Leonard Sinclair, chairman of Esso Petroleum Co., Ltd., since 1951, who on June 8 completed 50 years' continuous service with the company. He joined the Anglo-American Oil Co. (as Esso was then known) in 1908 as a 13-year-old junior clerk at a monthly salary of £1 10s 4d. After successive promotions in provincial branches, and Army service in World War 1, he was in 1933 appointed assistant general sales manager in London. During World War 2 he was a director of the Petroleum Board and in 1949 he became Esso managing director.

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Antarctica	Dominican Republic	India	Mexico	Syria
Argentina	Dutch New Guinea	Indonesia	New Zealand	The Philippines
Australia	Ecuador	Iran	Norway	Turkey
Bolivia	Egypt	Italy	Pakistan	United Kingdom
Brazil	El Salvador	Japan	Panama	United States
British New Guinea	Falkland Islands	Kenya	Paraguay	Uruguay
Cambodia	Finland	Korea	Peru	Venezuela
Canada	Formosa	Laos	Puerto Rico	West Africa
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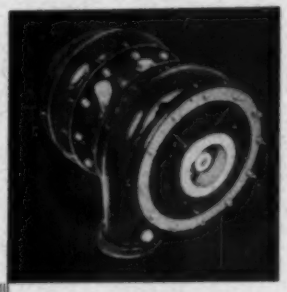
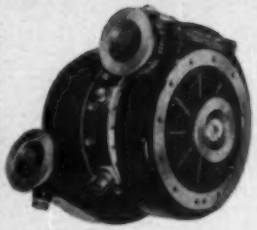
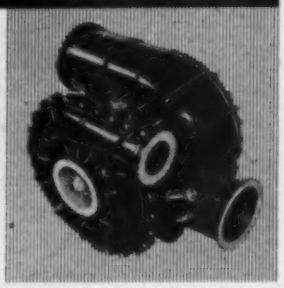
HUNTER	●
JAVELIN	FAIREY FD-2







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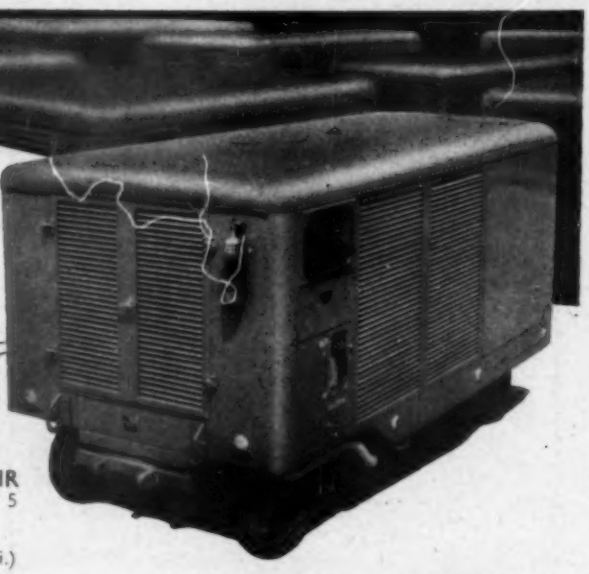

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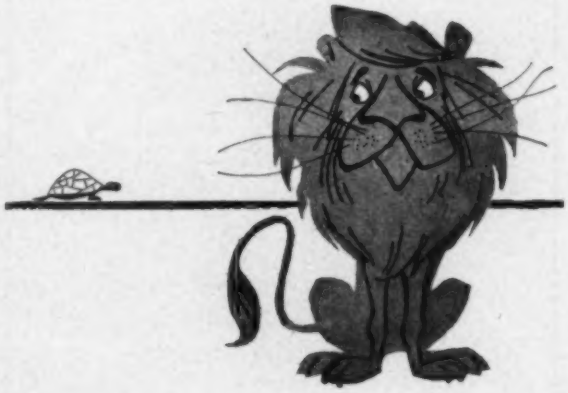

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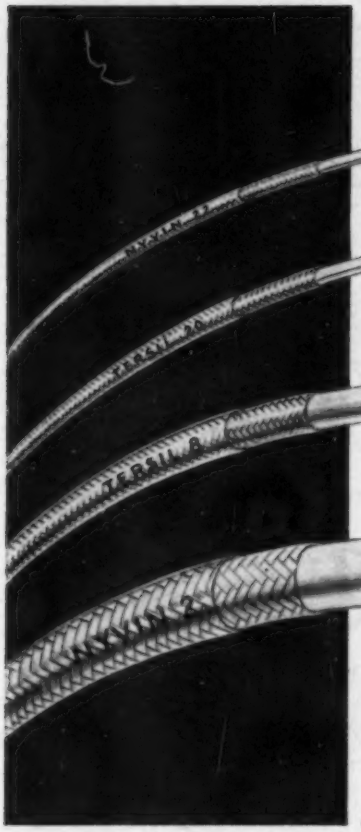

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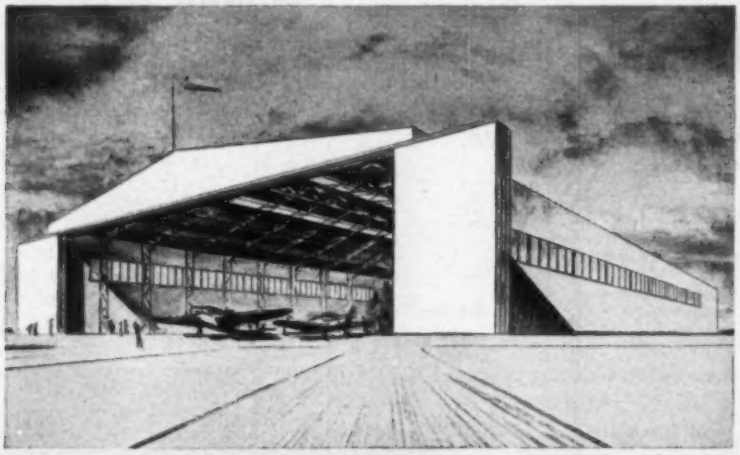

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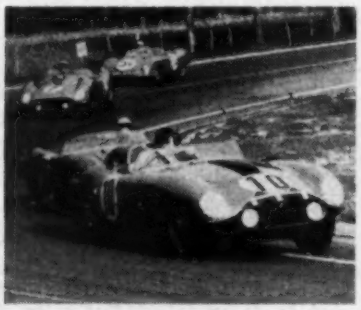

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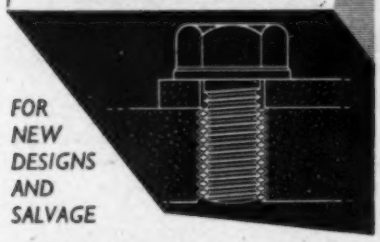

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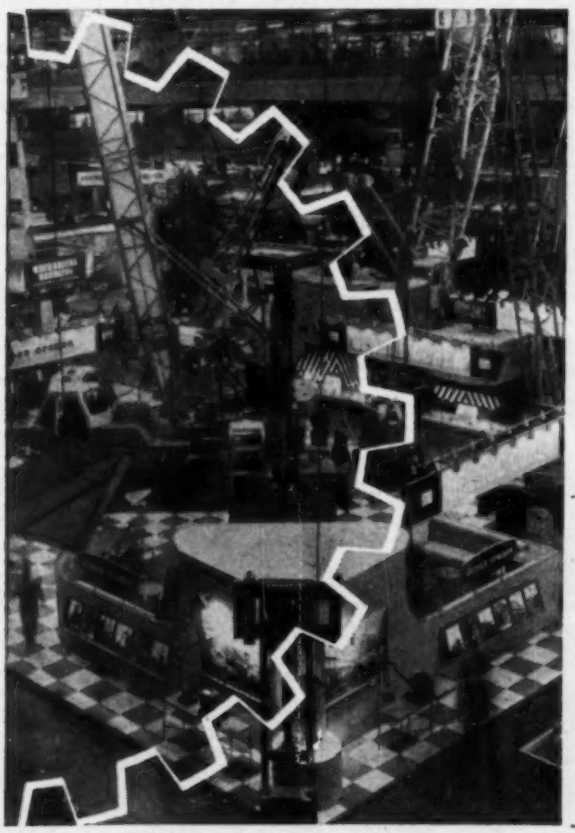

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FRENCH STRIKE FIGHTER FLIES 1,000-KM CLOSED CIRCUIT AT 649·7 MPH

Powered by the Bristol Orpheus lightweight turbojet, a Breguet 1001 Taon strike fighter has broken the world speed record for the 1,000-km closed circuit.

The Taon covered the specified distance in 57 minutes 23 seconds—*an average speed of 649.7 mph*. It was powered by a standard Orpheus B Or 3, developing 4,850-lb thrust. The previous record speed was 635.66 mph, achieved by an aircraft fitted with an 8,160-lb thrust engine.

The Orpheus/Taon's new record has been officially confirmed by the Fédération Aéronautique Internationale.

World's most advanced lightweight turbojet

The Bristol Orpheus is the most advanced lightweight turbojet in the world—outstanding for its thrust to weight ratio and design simplicity. The B Or 3, weighing 825 lb, has a thrust/weight ratio of almost 6:1.

Latest version, the B Or 12, has a still higher ratio, giving 6,810-lb thrust dry, over 8,000-lb with Bristol simplified reheat. This engine is to be installed in the developed version of the Breguet Taon.

Already the Orpheus is specified for no fewer than 14 different types of aircraft in 8 countries.

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